

ANNALS OF SURGERY

A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE

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VOLUME LI
JANUARY—JUNE, 1910

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1910

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ANNALS OF SURGERY

VOL. LI.

JANUARY, 1910

No. 1

ORIGINAL MEMOIRS.

THE BLOOD IN SURGERY.*

A HISTORICAL AND CRITICAL STUDY.

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THERE are three commonly accepted methods of studying a problem—whether that problem be a political propaganda, a question of social science, a biological puzzle, a piece of medical research, or an undertaking in practical mechanics. These three methods we call severally, (1) the inductive method of the scientist; (2) the practical method of the technical craftsman, and (3) the literary method of the student. Take, for example, the steam-engine as a problem to be investigated: the *scientist*—the properly trained physicist, studies the force-production of coal and the expansive power of steam acting upon a complicated mechanism of steel for the accomplishment of work; on the other hand, the *technical craftsman*—the trained mechanic, is concerned with the construction of the apparatus, the firing of its boilers, and the setting it in motion; while by the literary method the *student* of steam power as applied to the development of civilization

*The Annual Discourse before the Massachusetts Medical Society, June 16, 1909.

looks to remote causes, and to effects immediate and remote. The last named—the student—reviews the observations and hypotheses of the ancients; the vagaries of the mediæval alchemists; the crude, practical endeavors of the early moderns, and so he comes down to the accomplishments of Watts and the Stevensons, and grasps the significance of those prophets of modern industry; while he summarizes and assigns to their proper perspectives the vast individual factors in the complex of modern life as affected by steam power; foreseeing perhaps—or attempting to foresee—the bearing of it all upon the mechanic arts of the future and their influence upon the history of the race.

These three methods of study are applicable as well to medical problems, and the three classes of workmen find their labor in appropriate fields: The scientist investigates in his laboratory questions of biology—of physiology, anatomy and chemistry as concerned with the problem in hand. The technical craftsman, or practical clinician, as we call him, carries to the sick-bed the findings of the laboratory, and demonstrates their significance in the vital field of therapeutics. And finally, by the literary method, the student of medicine as a whole—of medicine in its wide bearing upon human happiness and progress, adds his quota also to the elucidation of the problem. It is his function to trace out and to collaborate the story of men and of measures: on the one hand to show, in the broad sense, the immense influence which the progress of medicine has had upon the progress of civilization, medicine's present significance and its probable future; and, on the other hand, and in a narrower sense perhaps, to trace the growth of our knowledge of special diseases. In this way best, I believe, may one reach a proper conception of the attainments of our predecessors; of the place at which we are arrived; of the value of special research; of the futility of certain lines of endeavor; and of the rate and probable outcome of to-day's progress.

This third method of studying problems in medicine is a method deserving more consideration than we have always

given it. We are prone to consign it to the dust-bin of medical history—of history in the nonphilosophic sense; but the study of medical history, properly pursued, means something more than the resurrecting of remote happenings—the dry bones of an emotionless past. Past and present are interwoven closely in such studies. The most successful clinician or investigator of to-day will be the first to appreciate the bearing of past facts upon present problems; while the intelligent recorder of past events must be versed and facile in the conduct of modern research and in the interpretation of clinical facts.

To be specific, in the following paper I propose—somewhat haltingly, I fear—to consider the subject of the Blood in Surgery from our third point of view—the point of view of the student of literature. In these days most of us who investigate this matter are busied, some with laboratory studies on the effects of hemorrhage and on the results of transfusion, and some in applying directly to patients the measures proved useful by laboratory experimentation. Shall not we here properly and timely, therefore, review the development of studies in the blood as we see them to-day?

The problem of the blood in surgery presents certain features, which I shall recall to you; and I shall discuss these features from the historical standpoint as well as from the critical standpoint of the present. We shall consider the *circulation*, *hemorrhage*, and *transfusion*, while various cognate matters incidentally must be developed.

Let us turn first to a discussion of knowledge of the circulation, as it became clear gradually to physiologists. No subject in the history of medicine is more vital or illuminating. In a former writing, on Aneurism, I said some little on this matter, but in that writing I was concerned with a field more narrow than that we are now considering.

To the ancients the problem of the circulation was truly a problem, though time and again some prophet arose who thought he had solved it. It is interesting to recall the fact that the great Hippocrates early in the Third Century B. C.

described the heart as a great muscular engine, even though it was not clear to him what function the heart served. Yet, five hundred years later, Galen taught his Roman students that the heart is *not* a muscle. Galen led physiological thought for fifteen hundred years, with the result that his misconceptions regarding the heart turned away to false conclusions hundreds of his successors. This fact is especially surprising when we remember that Aristotle, the great natural philosopher of Greece, soon after Hippocrates, about 340 B. C., had stated that the heart is the central organ of the circulation and is the mover of the blood.

In the light of history we cannot but marvel at the centuries of ignorance and misconception which followed the two assertions of Hippocrates and of Aristotle—their assertions that the heart is a muscular organ, and that it moves the blood. Unhappily for the progress of physiology, however, Aristotle believed that arteries and veins serve the same purpose¹ and bear blood equally to the extremities. Erroneous as was this idea the matter was made worse by Praxagoras, who wrote a generation later, and distinguished sharply between the functions of these two forms of blood-vessels, but distinguished wrongly.

Praxagoras observed that the arteries pulsate, while the veins lie apparently motionless. Thereupon, instead of recognizing the obvious fact that the movements of the arteries are due to the heart's impulse behind them, he asserted that the arteries beat because they are empty of blood, and are moved by a mysterious *pneuma*, to which he gave the name "vital spirits"—a *pneuma* much resembling air in character. We all know of this old error, but we must remember that it was an error quickly exploded. To be sure the conception of these air-tubes led to the adoption of the name *artery*, but the trachea also was dubbed artery, long before the name artery was applied to any vessel concerned with the circulation.

Galen was the medical philosopher who set straight the ancient misconception of the arteries' contents. One is tempted always to dwell upon the life and accomplishments of

this extraordinary man—unquestionably the most distinguished medical scientist of the old world. But we must brush by him, noting merely that he died about the year 200 of our era. He studied and demonstrated physiological phenomena through animal experimentation. He proved beyond peradventure that both arteries and veins contain blood, and that the wounding of an artery or a vein may suffice to draw away all of the life stream. His knowledge of the nature of the circulation was at fault in many other regards, however; and as his views controlled medical beliefs for nearly sixty generations, and directed those beliefs into channels which now seem to us preposterous, it is worth our while briefly to glance at his teachings.

Galen and his successors were convinced that the system of veins springs from the liver, whence the venous blood draws its nutritive properties; and that the system of arteries springs from the heart. Those men recognized the fact that both veins and arteries mingle in the lungs, but the significance of that mingling they did not comprehend. Here is a fact, however, regarding these ancient men and their conceptions: The men seem never to have guessed, or even to have suspected the existence of that thing which we call the *circulation* of the blood. They named the arteries and veins—*blood-vessels*, the term which we still employ; but they used the word—*vessel*—to signify a blood container, a pitcher or a bowl as it were. The blood in these vessels—they thought—lies in them as water lies in a lake, and does not course through them as water flows in a river. One asks, naturally, how the blood, especially the blood of arteries, could be discharged in jets when the blood-vessel is wounded. Galen asserted that the arteries in themselves—in their own walls—contain a vital principle which causes them to dilate and contract. Strangely enough, he appears to have seen no special connection between the contractions of the heart and the throbbing of the arteries. He did realize, however, that there is probably some communication between the arteries and the veins; but he taught that this communication is mainly accom-

plished through the medium of minute openings in the ventricular septum of the heart, through which he imagined small portions of the blood-stream constantly to percolate. We know, indeed, that he used the word *anastomosis*, for Galen, as well as his predecessors in the Alexandrian School, believed that there is a communication between the terminal branches of both veins and arteries. Galen asserted this communication without being able to prove it; indeed, he demonstrated that this communication plays an important part in the bleeding to death of an animal and the exhausting of its veins, when an artery is opened; but in spite of the soundness of this conception he failed still to recognize the constant and inevitable round of the circulation.

So we have seen, as Fleurens² points out, that before Galen's time there were three principal errors in the conceptions of the circulation: the first, that the arteries contain air only; the second, that the ventricular septum is perforated; and finally, that the veins, as well as the arteries, carry blood to the extremities. Galen corrected the first error—the air error—but his false notions of the perforated septum and centrifugal function of the veins remained an accepted doctrine until after the Revival of Learning.

Curiously interesting is the return to a discussion of the circulation in the early years of the Renaissance. One of the great followers of Galen was Mundinus of Luzzi, who taught anatomy at Bologna in 1315. He reiterated Galen's story of the circulation and fixed it firmly in men's minds for more than three hundred years. In some sense he was our earliest modern comparative anatomist. Among other teachings he delivered himself of the following luminous statement: Man is to be distinguished from animals in that man has no tail, "because being naturally erect he rests himself by the sitting posture, and a tail would interfere with his sitting down." *Hec sufficient de anatomia totius.*

We must recall also the shrewd Da Carpi who lived two hundred years after Mundinus, and followed closely his teachings. Da Carpi also taught anatomy at Bologna and dis-

tinguished himself by the astonishing discovery that men sometimes have been born with the heart covered with hair. On this account such men are braver than other peoples. In spite of this striking discovery, however, Da Carpi still clung tenaciously to the teachings of Galen.

Mundinus and Da Carpi were early prophets of the Italian schools, but a greater than they was to arise while Da Carpi was still living. This was Andreas Vesalius, the famous surgical anatomist, a Belgian by birth, who was called to the Chair of Anatomy at Padua in his twenty-third year. Vesalius is one of the most brilliant and attractive of our early heroes—the first great modern who refused to accept without demonstration the teachings of Galen. His work was done mainly in the anatomical theatre, and was concerned but indirectly with physiological problems. Vesalius came early to doubt those apocryphal percolations of the ventricular septum—“I still do not see how even the smallest quantity of blood can be transfused through the substance of the septum from the right ventricle to the left.”

This great writer offered no explanation of the transference of blood from veins to arteries, but evidently he was impressed with the unreality of the accepted teachings and with the need of further study of the circulation. It is reasonable to suppose that his early retirement from teaching and his premature death postponed for a century the true explanation of the circulation.

Harvey, the distinguished English physiologist of the Seventeenth Century, is the man to whom we look as the discoverer of the circulation of the blood; and yet Harvey had that astonishing predecessor, Servetus, of whom too we hear too little. Servetus asserted the arteriovenous anastomosis in the lungs. He was a fiery soul—a bumptious opponent, a polemical disputant, always at odds with the authorities, whether civil, medical or theological. He was a Spaniard, born in 1510, four years before Vesalius; and Calvin burned him up at Geneva, when he was forty-three years old. Those were thorough-going days, and in this way the burning came

about. Though a physiologist, an anatomist, and a rebel against the Galenic teachings, Servetus was animated chiefly by a hatred of churchly dogma, whether of the old or the new school. He used his own recently discovered physiological facts to overturn religious conceptions, and he wrote a book called "The Restitution of Christianity"—preaching a return to the primitive faith and life. He found that the Scriptures say the soul is in the blood, and that it gets into the blood through the air; but, to do this, the blood must circulate through the lungs, which indeed it does, says he. The venous blood does not percolate through the ventricular septum, "but by a grand device, the refined blood is driven from the right ventricle of the heart in a long course through the lungs. By the lungs it is prepared, assuming a bright color, and from the *vena arteriosa* it is transferred to the *arteria venosa*."

This was not the sum of his sinning, but at any rate the hard-fisted old Swiss reformer seized him when he found him in Geneva; and burned him up, with his books. Two copies only of the "Restitutio" have survived, so far as I know—one in the National Library in Paris, the other in the Imperial Royal Library in Vienna.

Various other commentators on the circulation lived in the time of Vesalius, but none, not even Vesalius himself, seems to have recognized the work or the existence of Servetus. Rialdo Columbus of Padua indeed reasserted, or rather, independently discovered the pulmonary circulation, and denied vigorously the common belief in an open ventricular septum—while Cæsalpinus of Pisa, towards the end of the Sixteenth Century, again described the complete flow of blood through the lungs, and devised the word *circulation*.

Although the three writers I have named last—Servetus, Columbus, and Cæsalpinus—asserted the fact of the pulmonary circulation, they asserted it from inferential reasoning, and not from demonstration; and mark this especially, that no one of them, save Cæsalpinus, had a word to say about the *general* circulation. Now Cæsalpinus in 1583 made this remarkable

statement: Blood is conveyed to the heart by the veins; receives there its perfection, and this perfection being acquired, it is carried by the arteries to all parts of the body.³ It is hard to see how this can be any other than a clear assertion that there is a *general* circulation. Unfortunately Cæsalpinus' contemporaries do not seem to have grasped the significance of his surprising assertion, if we accept the account of Fleurens, who brilliantly defended him some fifty years ago. Our own Dalton, writing in 1884, makes this astonishing comment on the work of Cæsalpinus: "It must be evident that there is nothing in this passage which would imply in Cæsalpinus a knowledge of the general circulation." This is an old controversy, important only, perhaps, to the medical historian. For myself, I cannot but believe that Cæsalpinus knew of what he wrote, and that we should take literally his writing.

We note one other name before coming down to Harvey himself. Fabricius ab Aquapendente in 1574 took note of the valves of the veins, but failed to perceive their significance in assisting the flow of venous blood towards the heart. He supposed they serve the purpose of little dams, constructed to oppose the too violent rush of venous blood from the heart to the extremities.

Then came Harvey, whose name marks the second period of interest in the history of the circulation. Three years ago Osler delivered the Harveian Oration on the "Growth of Truth," an oration so well known to us all that it is needless here to rehearse the orator's collected facts of Harvey's life and career. Suffice it only to remind you that Harvey was in Italy at the end of the Sixteenth Century, when the medical atmosphere of the Italian universities was charged with the new interest in physiological studies, and that he was an actual pupil of Fabricius, the discoverer of the vein valves. As Fleurens says, when Harvey appeared, everything relative to the circulation of the blood had been indicated or suspected; nothing had been established.

In the year 1616—fourteen years after his return home—

Harvey was made lecturer on anatomy at the College of Physicians in London; and in 1628, twelve years later, he published the first edition of his great work—even to-day a wonderful volume, though it is but a little book. Dalton writes of it: "This volume, a small quarto of seventy-two pages, undoubtedly contains a greater amount of important material in small compass than any other medical work ever published." Here we recall the facts merely that he took up *seriatim* the organs concerned with the circulation. He discussed the structure and action of the heart; the successive contractions of the auricles and ventricles; the passage of venous blood from the right auricle to the right ventricle and to the lungs; the passage of blood through the pulmonary vein to the left auricle, to the left ventricle, and to the aorta. He observed the valves, membranes and *ostiola* which are found at the entrance to each of the passages. He traced the blood through the arteries, and showed that the arterial pulsation depends upon the pulsation of the heart. Then he passed to the veins, and from a study of their valves drew the important deduction that venous blood can flow only *towards* the heart. He opened arteries in animals and perceived the rapid exhaustion of their blood, and the death from hemorrhage, from which he argued that blood circulates throughout the body with great rapidity.

One important step in the circulation, however, was not clear to him—the movement of the blood from the arteries to the veins through the capillary network, in both the general and the pulmonary circulation. He was convinced that in some way the blood does pass, and he conceived of a transudation through the parenchyma of organs,—a transudation, not through anatomical vessels, but through the structure of the tissues themselves. In this conception doubtless he followed the reasoning of Servetus, of Columbus, and of Cæsalpinus.

It remained for Anthony van Leeuwenhoek in 1688 to complete the story begun by Harvey. Here is Leeuwenhoek's graphic description of his first sight of terminal anastomosis. He studied with his crude microscope the organs of tadpoles,

and was able to observe the flow of blood through their terminal arteries and capillaries. In a letter to the Royal Society of London, he exclaims with enthusiasm: "Having seen this many times to my great satisfaction, I would not keep the knowledge to myself, but I showed it to five distinguished gentlemen, who told me that they had never seen anything deserving so much to be seen. . . . We could not possibly have distinguished it, but as the blood consisted of a very clear liquid mixed with larger and smaller globules . . . so the observation of the circulation was the more distinct." Van Leeuwenhoek spoke the last great word in the story of the circulation.

With the establishment of an understanding of the circulation, there came about gradually a readjustment of the old conceptions of blood-vessel diseases and injuries and of their treatment; while the significance of hemorrhage, grave as that significance always had been, became still more appalling. I fancy that the poets and prophets of old time made more mention of the blood than did many of the philosophers and physiologists even. Vainly one searches the writings of Hippocrates for any word upon hemorrhage from wounds, and Celsus, who wrote in the year 50 A. D., says merely that one must apply lint dressings and must tie vessels which are obviously bleeding.

Since the complete round of the circulation was not appreciated in ancient times, the possibility of the body's emptying itself of blood was not apprehended. The fear of the old surgeons seems to have been merely that blood-vessels immediately adjoining the wound would become emptied. Doubtless it was through this misconception and through recognition of the occasional value of bleeding that the widespread practice of venesection⁴ arose, which held bound conventional physicians for centuries, even after the actual discovery of the circulation.

The truth about the circulation of the blood had become acknowledged by all men at the beginning of the Eighteenth Century; but vital as was the truth, generations passed before

surgical practice became modified. Indeed, the work of John Hunter in demonstrating collateral anastomosis about an occluded artery, was needed to bring home to surgeons the significance of a constant blood-stream.

The history of the *treatment of hemorrhage* up to recent times can be summed up in three words, pressure, cautery, and the ligature; yet one cannot study old writings, without perceiving that these methods commonly were not satisfactory. The use of pressure went through many phases—packing, tenting, handpressure, bandaging, acupressure; though strangely enough the tourniquet, the popular pressure instrument of to-day for controlling serious hemorrhage, was not satisfactorily developed until the time of Petit in the middle of the Eighteenth Century.

The old surgeons liked to employ pressure as a hæmostatic. They found, that pressure continued long enough, checked nearly all forms of hemorrhage; and that hemorrhage checked by pressure rarely broke out secondarily. The old surgeons did not understand the reason for this absence of secondary hemorrhage after the use of pressure, though we now know that the reason as contrasted with ligature treatment lies in the frequent elimination from the wound of sepsis-causing foreign bodies. A striking and original pressure method was that advocated in 1869 by J. Y. Simpson in Great Britain—the acupressure method. Simpson realized the disadvantage of ligatures, which in his time were left with long ends protruding from the wounds, that they might be pulled off when the artery had sloughed, and he devised the acupressure pin, an instrument resembling a hatpin, which was passed in from the outside of the wound, and was made to compress the vessel for two or three days, or until the artery was completely blocked by natural processes. He then removed the pin, and in consequence left the wound free from external irritants. The familiar Wyeth pin used in hip and shoulder amputations is the acupressure pin of Simpson.

The cautery (the actual cautery) was needed to supplement the uses of pressure; and the story of the cautery

wanders down through the history of surgery. If there were time, it would be interesting to quote Paré and his opinion of this barbarous hæmostatic. Paré could not stop its use, and the cautery continued to torture patients, to destroy valuable tissues, ineffectually to check hemorrhage, to create horrible sloughing, and to comfort the surgeon's conscience for generations after Paré's time. Indeed, the use of the cautery in its various forms was regarded as a fine art down nearly to our own day.

The ligature is one of the ancient devices of surgery. The Alexandrians used it before the Christian Era. Celsus commended it. Galen established its value for the control of vessels wounded in continuity; and finally Paré, in the middle of the Sixteenth Century, reintroduced it on the battle-field as *the* hæmostatic in amputations. The ligature was an improvement over the cautery and the equally barbarous boiling oil; but even so, the ligature was a constant source of danger, and an incentive to secondary hemorrhage until after the introduction of the principles of Lister.

J. F. D. Jones, an English surgeon of 1810, states: "The records of our profession afford us few and detached observations on the suppression of hemorrhage, if we contrast the knowledge we possess with the importance of the subject." A hundred years ago Jones produced a valuable book on this matter—a book dealing with the dangers of hemorrhage, its treatment by drugs, the operation of the ligature, and the nature of the healing of arteries; and his treatise contains fifteen remarkable plates which demonstrate the character of arterial wound-healing. Jones discourses at interesting length on the studies of other men upon hemorrhage and the nature of hemorrhage; and with commendable accuracy describes the knowledge of hemorrhage and its treatment as such knowledge existed in **his time**.

Such, as I have sketched them, were some of the measures used to combat active hemorrhage; but one finds also surgeons in all times endeavoring to correct the exhausting ill-effects of hemorrhage after the flow of blood had ceased—the employ-

ment of after-treatment, as we call it. Indeed, such stimulating and upbuilding measures always have been familiar, rational and effective, so far as history or legend carry us. Rest and nourishment, repose and stimulation—those for centuries were the means employed to bring back to health patients exhausted by hemorrhage. Freedom from apprehension, as well as freedom from pain, has always been recognized as supremely important. So we find Hippocrates and Celsus, Vesalius and Harvey, Paré and Wiseman prescribing supporting food, and enjoining soothing medicines. Andrew Blake a century ago wrote, "but opium is necessary . . . with the view of quieting tumult and where the pain is excessive."

Though such were the measures commonly used to check hemorrhage and to re-invigorate the body, wise surgeons and physiologists were appearing here and there, in ancient times even—wise men who looked for still more prompt and effective measures for restoring the lost strength and the lost blood. Since loss of blood was seen to be the immediate and obvious cause of the loss of strength, we expect to find surgeons seeking to put back *fresh blood* into the exhausted tissues,—and indeed, we do so find them.

All men know that our recent successful employment of *transfusion* is a revival and an improvement of a former practice; but few men realize that the conception, if not the practice, of transfusion is nearly as old as medical literature. In the development of much modern surgical progress we are going over the old ground and following the old steps in somewhat the same order as the ancients went and followed before us.

Modern surgery took up first the investigation and treatment of *gross and obvious lesions*—compound fracture; abscesses, and inflammations from infection—such as appendicitis; and tumors, innocent and malignant, such as ovarian cysts, uterine myomata and breast cancers. Then surgery expanded to concern itself with *derangements of organs*—ureteral obstruction, gall-bladder hypertrophy and pyloric

stenosis. Next, in a burst of energy, it advanced upon the *more intimate seats of life*; it took up impaired nervous structures, brain tumors, and peripheral nerve lesions; and finally, inspired and strengthened by recent teachings in physiology, it has succeeded actually in repairing damage to the heart, in mending diseased nerves, in joining severed blood-vessels, and in replacing amputated organs and limbs. In the midst of all this enterprise there has been involved inevitably the question of *conserving the blood-stream*; and while we are concerning ourselves with questions of blood-vessel surgery, we are not forgetting the *Blood*.

The surgery of ancient times developed along lines parallel to the lines I have just sketched, and it reached many important conclusions and outposts. The thought, if not the practice of *transfusion*, was familiar to men of Virgil's time.

Oré,⁵ the well-known French writer on transfusion, has discovered many references to the ancient use of blood-transference. He finds that it was employed among the early Egyptians; in the armies of the Roman Republic, and by the Jews of Bible times; while it is mentioned by Pliny, Celsus, Ovid, Libavius, Fabricius ab Aquapendente, Harvey, and sundry others.

Many of the older essayists on the history of transfusion speak of transfusion as though it had been performed commonly; but, indeed, there is no good evidence that it was ever systematically and intelligently performed until after the middle of the Seventeenth Century. There is one rather amusing and striking anecdote always related among the early cases of transfusion—the case of Pope Innocent VIII, who died in the year that Columbus discovered America. Writers, following the text of Sismondi, used solemnly to assert that the prelate, finding himself about to die, was persuaded by his Hebrew physician to consent to submit to the transfusion of blood, after the usage of certain practitioners, although they had never tried it “except on animals.” Accordingly, three boys about ten years of age were bought, and their blood drawn. All three are said to have died at the

beginning of the operation, probably from air embolism. In spite of these heroic efforts to save the pontiff, he himself died a few days later.

If the story is true, this is the first well-recorded instance of transfusion. Unfortunately, however, the critics have denied the anecdote; especially has Casse⁶ denied it, who has written an entertaining monograph to prove the improbability of that old-time transfusion. Whatever the rights and wrongs of the tale, the fact remains that the thought of transfusion, especially as between animals, was familiar to surgeons of the Renaissance.

On June 15, 1667, nearly two hundred years after the lamentable demise of the three Italian boys, Jean Denys in Paris tried transfusion in man for the first time in French history. Although the experiment seems to have succeeded, the community was roused to an extraordinary pitch of excitement, and opposing factions were formed—these praising and those abusing the novel undertaking. Finally, after a year, the civil authorities took the matter in hand and formally prohibited transfusion in human beings.

Almost at the same time, in 1668, during the reign of Charles II, the Englishmen Lower, King, and Wren, the Italians Riva and Manfredi, and the Germans Kaufmann and Purmann, succeeded in transfusing blood from man to man. All of these experimenters used an extremely crude and dangerous method. They drew venous blood from the donor, received it in a vessel, and then poured it through a tube or catheter into a vein of the patient. The inevitable accidents happened; clots and air were introduced into the circulation of the sick man; little benefit resulted, and an occasional death was reported. The operators became discouraged and the community alarmed. The procedure came into contempt. This outcome was a grievous disappointment to enthusiasts, for the thought of transfusing vigorous blood had aroused tremendous interest and hysterical hopes,—the sick were to be made well; the old were to be made young, and perpetual youth was to become the happy lot of all men.

Shattered hopes were not revived for many generations. Early in the Nineteenth Century, after nearly one hundred and fifty years, Blondell and Doubleday, the Englishmen, instituted again transfusion by a successful operation on a woman dying of postpartum hemorrhage. Recent interest in the procedure dates from that year, 1818, the beginning of the modern, or *third period* of transfusion history, as Oré calls it.

Blondell was indeed experimenting in a field practically untrod; but he reached conclusions of striking importance, if only they might always have been proven true—that the passage of blood through a syringe does not curtail the blood's functions; that small quantities of air in the veins do not especially endanger the life of the patient; that blood transference from artery to vein is hazardous; and that human blood transferred to a dog may kill the latter. Two years later, Prévost and Dumas, after a series of experiments, were able to assert that immediate transfusion through a tube may properly be made from the artery of one animal to the vein of another.

The third transfusion period lasted for more than half a century. It covered the years from those early experiments of Blondell's to the time of the firm establishment of aseptic surgery—that is, to about the year 1885. During this era a great deal of interest regarding transfusion was written and was said. Pect, in 1841; Soden, in 1852; and Higginson, in 1857, urged vigorously the value of transfusion, and discussed various methods of employing it. Especially Bischoff, in 1835, urged the value of defibrinating the blood drawn, and then injecting it by the indirect method, that is by collecting it in a vessel and then passing it through a tube into the patient—as contrasted with the direct method, the passing of blood from donor to recipient through a short intervening tube only. Many surgeons were convinced that Bischoff's practice of using defibrinated blood marked a revolution in surgical therapeutics, and his method was extensively tried throughout Europe.

Numerous ingenious apparatus were devised; one of the

best perhaps being the funnel of Higginson, which was so constructed as to keep the blood warm in a hot-water chamber—while Brown-Séquard, in America in 1857, carried the process further by oxygenating the blood before injecting it.

In 1871, De Belina, in Paris, gave a further impetus to the use of transfusion by important studies and clinical demonstrations, and wrote these words: "Not only do these cases show in an inevitable manner the value of transfusion in post-hemorrhagic anæmias, but also in asphyxia and eclampsia; and open a vast field to those future experimenters who shall profit by what has already been accomplished."

The discussion and enthusiastic work went on. Roussel of Geneva, in 1876, had become a recognized authority on transfusion. This earnest writer returned to the direct method and asserted that transfusing blood can mean only conducting without interruption and without contact with modifying agents, the living and unaltered blood, from one organism to another, so that it can produce all those vital effects which constitute the real rôle of the blood: and to this end a transfusing apparatus should be a direct anastomosis only from one vascular system to another. This illuminating statement gives us pause, and we think we have leaped at once to the latest modern method; but we find that Roussel did not look ahead so far. His direct anastomosis was through what he called an "artificial heart." To-day we should content ourselves with the more familiar name—Davidson syringe. He used what was in effect that familiar syringe, made of "pure unadulterated india-rubber," for which he claimed great virtues; and he pumped 200 Grams of blood from vein to vein in five minutes. Incidentally, we learn from Roussel's article, that the governments of Belgium, Austria, and Russia had already at that time (1876) furnished their army surgeons with a good transfuser, from which we are to suppose he means his own transfuser.

All the writers in what I have called the third period of transfusion seem to have had a sound understanding of the physiology of the procedure. They recognized not only the

value of fresh blood *per se*, but the importance of fluid in bulk supplied to the exhausted circulation. Few of them, however, if we except Roussel, transfused large quantities of blood. For example, P. T. Morton, of the Pennsylvania Hospital, in 1874, writes of eleven ounces of blood as the largest amount that he had ever transfused, and his experience was considerable; while he states that he has known two ounces to stimulate the heart and save life when that life was on the verge of extinction.

All the writers speak of the numerous conditions in which transfusion is of benefit—for exhausting hemorrhage, whether from wounds, from childbirth, or from gastric and intestinal ulcer; for asphyxia of the new-born; in illuminating gas-poisoning; in chronic anæmia, whether primary or secondary; in epilepsy; septicæmia; uræmic poisoning,—and in all these and similar cases they urge the performance of transfusion early—not waiting until the patient is at the point of death.

About thirty years ago, numerous experimenters began to advocate the employment of fluids other than human blood for infusion. So long ago as 1830,⁷ Jœnichen of Moscow practiced and advocated intravenous saline infusions in cases of persons dying of asphyxia; while Roussel, in 1876, pointed out the propriety of employing the term *transfusion* to indicate blood-transference only—the term *infusion* to indicate the injection into the body of some substance other than blood. The suggestion of Jœnichen was adopted by numerous investigators: Schiff and Gaule demonstrated the value of saline infusions in cases of acute anæmia; Bischoff, the same who advocated the employment of defibrinated blood, made a brilliant success with the injection of saline solution, an agent which numerous other experimenters down to our own time have shown to be of life-saving value.

In the early days of the use of saline infusions, and later, nearly up to twenty years ago, certain enthusiastic surgeons asserted, and with great show of reason, that salt solution was far preferable to blood as a vehicle of cardiac stimulation. In some sense and for obvious reasons, these assertions were

true, for salt solution is readily obtained, and is safely employed. No physiologist, however, could admit any intrinsic superiority in salt solution over blood. Eighteen years ago, Matas expressed the situation correctly in saying that *mechanically* or *physically* saline infusions are the rivals or equivalents of blood infusions, while, *physiologically*, salt solutions never can rival or equal blood.

It is extremely interesting to read in this early writing of Matas (1891) these words also: "In speaking of blood as a medium for transfusion, we mean, of course, only pure, entire, living blood, and not the altered pathological material, known as defibrinated blood. We also mean blood of the same species, and not that derived from heterogeneous sources." This last statement, which suggests a knowledge of the hæmolyzing effect of blood of different species, had first been enunciated by Panum, writing in Virchow's *Archives*, and quoted in 1871 by De Belina, who makes this interesting statement: "The bloods of animals can revive animals of a different species, but only as a result of its passage. It decomposes at once, and if it has been injected in small amounts can be eliminated without causing disturbance; but if it has been injected in large amounts, it can cause death."

The convictions of Matas, expressed eighteen years ago, as I have quoted them, are the convictions to-day of surgeons the world over. We all use saline infusions in cases of hemorrhage, after the bleeding has been checked, as well as for various other accidents threatening life. At times we supplement the simple saline by fortifying it with adrenalin, but our principal proposition maintains: we need to support by the bulk of the injection the vital or central avenues of the circulation, the heart and the blood-vessels in the trunk and in the brain.

The whole subject of the value of saline infusions in the treatment of hemorrhage is too familiar to need repetition, especially in view of the elaborate work of Crile and Dolley, which they sum up in an admirable paper published three years ago.⁸ Those writers refer briefly and almost casually

to two important facts regarding the use of saline infusions—two facts which indicate the limits of its value, and mark off sharply its physiological action from that of transfused blood: (1) In the case of an anæmic heart, there is always a possibility, or the probability even, that an intravenous infusion may precipitate an acute cardiac dilatation. When the pulse-wave is large, when the pulse-resistance is slight and the rhythm slow, we must use infusions with extreme caution. (2) The blood does not tolerate great dilution. Large amounts of salt solution pass quickly through the great blood-vessels, and accumulate in the lungs, the pleural cavity, and the abdomen, with the result that the patient not only loses the benefit of the salt solution in his circulation, but may chance to find himself seriously embarrassed by abnormal accumulations of fluid in the trunk cavities.

Thirty and more years ago, surgeons were not satisfied that saline solution was the best agent to accomplish the benefits of which we now know it capable. They experimented with many other agents and with apparent success—with weak solutions of albumin, of bicarbonate of soda, of glycerin, and of milk.* T. Gaillard Thomas especially, in 1878, reported a series of remarkably interesting results from the infusion of milk,⁹ and stated—a fact often forgotten—that this novel agent was first employed on man for infusion so long ago as 1850 by Edward M. Hodder, of Toronto. Hodder had given as much as fourteen ounces of milk at a single injection; but Thomas convinced himself that eight ounces is the limit of safety. These experimenters and others found that absolutely fresh and sterile milk should be used, as decomposing milk quickly causes death. Thomas collected twelve cases of milk-injection, and wound up his paper with the following rather pathetic statement: "I should be false to my own convictions if I did not predict for 'Intravenous Lacteal Injection' a brilliant and useful future."

* The history of milk injection can be traced back to the year 1667, when Johannes de Muralto of Zurich practiced the injection of milk into the vessels of one of the lower animals. Statement by August Schachner in the *American Medical Practitioner and News*, October 31, 1896.

In spite of such rather freakish and bizarre experiments, the value of infusions of some sort continued to attract the confidence of the profession, but by 1890, the saline infusion had taken a front place as the one safe and available agent.

Saline infusions, however, have not always been given in one and the same manner. For example, Johnson-Alloway employed successfully in a case of desperate collapse from hemorrhage, the infusion of salt solution into the peritoneal cavity—injecting three quarts at a temperature of 110°, through a glass drainage tube, when he found that this fluid was taken up rapidly by the exhausted circulation; while Dawbarn in 1892, and H. A. Kelly in 1894, advocated the injection of saline infusion directly into an artery. Dawbarn devised the technic of inserting a hypodermic needle into the femoral artery, and sending the infusion through the needle by the force of a Davidson syringe—the fluid at a temperature of not less than 120° F. This writer maintained at the time that two quarts at least should be injected. Kelly infused a litre of salt solution *centrally* into the radial artery of his patient, forcing the fluid towards the heart through a cannula introduced into the artery. Both of these experimenters were satisfied of the value of arterial infusion, claiming for it a quicker action than when the solution was injected in the ordinary way into a vein.

H. T. Hanks, of New York, writing in 1898, remarks: "Just how this simple salt solution acts in arteries may not be fully understood, but it is certain that the heart responds at once to the presence of the fluid. The cardiac and arterial ganglia are stimulated, whether the fluid is stimulating or not. . . . The additional fluid in the arteries certainly pushes on the half-stagnated capillary circulation, clearing out what would in a short time become semi-poisonous in itself. . . . The flushing out of the smallest blood-vessels by this diluted fluid is a virtue in itself."

Dawbarn makes this further note: "I need hardly add here that *blood-transfusion*, either mediate or immediate, has now been dropped by almost all surgeons. When a person

has bled to death, more than half the blood still remains in the body; and if this is properly increased in bulk by any innocent fluid, this added bulk is all that the heart needs to make it resume work." But note Schachner of Louisville, who stated in 1896 that transfusion of blood proper, though regarded by different writers as both safe and unsafe, can no doubt in the hands of a careful operator be made free from danger. He remarks, however: "From the history of transfusion it is apparent that formerly its range of application was far more extensive than its merits justified." Schachner says further, that the publication in 1891 of E. Schwartz, "On the Value of Salt Infusion in Cases of Acute Anemia," established the modern confidence in salt infusion.

We see then as a result of our researches that about the beginning of the present century surgical opinion had crystallized into the belief that blood infusions are hazardous, and that salt infusions are satisfactory and life-saving, because what is wanted is an increased intravascular pressure; that in some cases of alarming hemorrhage, infusion should be supplemented by transfusion with defibrinated blood; that the indications for infusion include any pathological state attended with a feeble pulse, and with shock; that the improvement of the circulation after infusion is due in part also to the stimulating influence which the hot salt solution has upon the heart, while at the same time "auto-infusion," a forcing of the blood by bandages from the patients extremities toward his centres, is an extremely useful manœuvre.

Every surgeon of a few years' experience recollects that such conceptions were held to be sound and such practices satisfactory a very few years ago; and he knows that in most emergencies such measures still suffice.

Within the past ten years, with the additional light thrown upon the nature of shock and on the effects of hemorrhage—our conception of a paralyzed or of an exhausted vasomotor centre—we have come to see that something more than the mere presence of salt solution in the blood-vessels sometimes is necessary to restore a depleted circulation; while the obser-

vation that excessive amounts of saline solution in the vessels may paralyze an enfeebled heart, or may be exuded into the cavities of the trunk, has brought about successful attempts to return to a more rational employment of the long-neglected blood transfusions.

It is a fortunate and interesting fact that with this swing of the pendulum, with this turning back towards an endeavor to utilize the blood itself, a flood of new light has been shed recently upon the surgery of the blood-vessels. Our knowledge of the healing of veins and arteries has been broadened, while at the same time we have learned the entirely novel fact that blood-vessels under proper conditions themselves may be repaired and anastomosed, so as to continue their normal functions. Taking advantage of this new knowledge, we have been enabled to make good the half-completed undertaking of Roussel the Swiss investigator, who asserted more than thirty years ago, that true transfusion means the passage of sound or unaltered blood from the arterial system of the donor to the venous system of the donee.

We are now approaching so vast, so intricate and so fascinating a theme that one may not properly in a brief paper do more than suggest the lines upon which studies of the blood in surgery are developing. Less than two years ago, Stephen H. Watts of the Johns Hopkins Hospital collected in a luminous monograph a statement of accomplishments in blood-vessel surgery up to that time. Since then further progress has been made—progress strikingly picturesque if not more practically important. The list of laborers in this field is already great. Watts gave us a bibliography of eighty-three numbers, and this bibliography to-day could be doubled. We in this country look especially to Abbe, J. B. Murphy, Carrel, Guthrie, Matas, Dorrance, and Crile for information on these matters. Indeed, there are many others, while the list of European investigators is a long one.

The first and most striking fact in *blood-vessel healing* soundly demonstrated by these investigators, is the fact of the ready adhesion of intima to intima, directly reversing the prin-

ciple upon which the *intestinal tube* is sutured—serosa to serosa. For some time it seemed as though the necessity of applying intima to intima in small friable blood-vessels would oppose a serious obstacle to the progress of vascular surgery; but thanks to the sound demonstrations of Carrel and of Guthrie, we have now been furnished with a simple and reliable technic, which answers practical purposes. We have learned further that for the handling of blood-vessels special training is required, and the employment of special agents—constant and proper lubricants, constant and unfailing warmth and moisture, and delicately and accurately applied needles and suture materials.

The surgeon who hastily and confidently undertakes any considerable work on the blood-vessels finds to his chagrin that the operation is anything but easy. We talk lightly of arteriovenous anastomosis and of transfusion by the method of Carrel or of Crile, but the novice at such work will find himself floundering in clumsy perplexity, and will exhaust hours of strength and patience unless he has equipped himself for the task through painstaking and faithful experiments on animals in the research laboratory.

For years Crile has taken the keen interest of a surgical physiologist in the nature and treatment of shock in hemorrhage. It was to be expected, therefore, that the development of blood-vessel surgery should suggest to him as to others the feasibility of practicing blood transfusion by utilizing our recently acquired knowledge of blood-vessel surgery. In July, 1906, he published one of his most extensive articles on the treatment of shock and hemorrhage through the use of *saline* infusions. In November of the same year he published his first article on the "Direct Transfusion of Blood in the Treatment of Hemorrhage."¹⁰ On April 20, 1907, he demonstrated on a patient before the Society of Clinical Surgery his method of transfusing blood.

Already at that time others had become interested in this important work, and now some hundreds of cases have been collected. It is needless here to suggest the types of cases

which are benefitted by this operation further than to state that the transference of blood from donor to patient is not limited by any means to that class of cases which are commonly called surgical. The treatment will benefit a great variety of persons who suffer from a diminished quantity of blood, or from an inferior quality of blood. One sees, of course, the value of refilling a circulation exhausted by hemorrhage, but frequent observations teach us that something more than the mere bulk of the blood benefits the patient.

Many observers, from Alexander Schmidt and Kohler to the investigators of our own time, especially Weil, Richet, and Leary, have pointed out that certain properties in serum, whether of animals or man, exercise a coagulating influence on the blood in cases of chronic hemorrhage. These observers have not been able to show, however, that the sera employed invariably act beneficially. On the other hand, small amounts of whole human blood transfused to a patient who suffers from repeated hemorrhages are sometimes found to shorten his coagulation time as well as to check the habit of bleeding.

Last spring I had a patient who illustrated the above fact: A girl of twelve who had passed through her first three menstrual periods with alarming bleeding at each, at the time of her second period, on the advice of Leary, was given 15 c.c. of rabbit serum by hypodermic injection. Leary noticed that blood oozed afterwards from the needle punctures for half an hour. Two days later the injection of serum was repeated, but was followed by no oozing from the needle punctures. Her next menstrual period was of the same character, and was treated successfully with guinea-pig serum. With the next, or fourth period, in May, 1908, she bled until nearly exsanguinated, when I was called to see her. She was in an alarming condition—waxy, nearly pulseless, prostrated, after ten days of continual bleeding. I transfused to her from a vigorous young man, her cousin, about six ounces of blood. Her bleeding ceased immediately, and within three weeks she was well; but the notable fact in the case

is that since May, 1908, more than twelve months ago, she has had the normal catamenia of a girl of her age.

Internists as well as surgeons are beginning to appreciate that the transference of blood is becoming an important therapeutic measure—but a measure whose ultimate value is not yet determined. The technic of blood transference is still somewhat debated—whether to use the direct suture of Carrel, or some mechanical device such as that of Crile, of Ottenberg, or of Levin.

At the same time that the therapeutic employment of transfusion is revived, doubts of its universal applicability are raised through modern knowledge of the nature of the blood and the blood content. *Iso-agglutination* and *hæmolysis* are terms which express conditions with which we must reckon,

By *iso-agglutination* we mean the clumping of the blood corpuscles of one person by the serum of another, and this phenomenon may have an important bearing on blood transfusion, for *iso-agglutination* suggests, as Hektoen pointed out two years ago,¹¹ that under special conditions homologous transfusion might prove dangerous by leading to erythrocytic agglutination within the vessels to which blood was transfused. Hektoen suggests that this possible danger can be avoided by the selection of a donor whose corpuscles are not agglutinated by the serum of the recipient; and whose serum in turn does not agglutinate the corpuscles of the latter.

The condition *hæmolysis* raises quite another question—a question the subject of much careful study during the past five years, and admirably summarized by Richard Weil in the *Journal of Medical Research* for October, 1908. *Hæmolysis* depends upon the fact that a red blood corpuscle is covered by a delicate membrane which is easily susceptible to change or destruction; and that when the membrane is so destroyed the important contents of the corpuscle, notably the hæmoglobin, escape. This destructive process is known as hæmolysis, and agents causing hæmolysis are termed hæmolysins. Among the organic hæmolysins are the blood and tissue juices of alien

species, and notably the blood and tissue juices of the same species when subject to certain pathological conditions. For example, in pernicious anæmia, in certain fevers, sometimes in chronic suppuration, and in certain cases of malignant tumors, there is such a change in the blood serum of the patient that his abnormal serum will hæmolyze the red corpuscles of a normal individual of the same species.

This phenomenon and the technic of the corresponding investigations are outside further discussion in this paper. but the significance is apparent, as well as the importance of determining hæmolysis in cases subject to transfusion. Moreover, the fact of hæmolysis may become, as we know, a suggestive factor in determining obscure diagnosis. Says Crile:¹² "Our conclusion is that hæmolysis occurs in a number of diseases. It occurs in great frequency in cancer and tuberculosis. The reaction in tuberculosis is the reverse of that for cancer." *

In view of the struggles of our predecessors to establish, make available, and popularize blood transfusion, and in view of their ardor and their recurring failures, the recently ascertained facts regarding the nature of the constituents of the blood are extremely illuminating. Denys, Lower, Kaufmann and their contemporaries failed successively to establish transfusion because they could not control clotting and air embolism. Blondell, Dumas, and their contemporaries in the last century failed to realize the danger of employing the blood of alien species; while Bischoff started the practice of defibrination, which for years led away his successors on a false trail. Brown-Séquard and his associates do not seem to have guessed even the intricate processes which mixed bloods may precipitate. The problem of transfusion is still by way of solution; the indications and the straight road are not always obvious. Our ancestors looked to transfusion for rejuvenescence and

* Wyman Whittemore, working in the laboratory of the Massachusetts General Hospital, writes (*Boston Med. and Surg. Jour.*, Jan. 21, 1909): "From these results, at the present time, hæmolysis is of no value in the diagnosis of carcinoma."

perpetual youth; we, in a more modest generation, may look to transfusion for the re-establishment of health in certain cases which hitherto we have often deemed hopeless.

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THE TWO-STAGE PRINCIPLE IN OPERATIVE SURGERY.*

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STRIVING toward perfection in surgery, we must make every effort to master the art of operating; yet our final goal is always the security of the patient. Our motto might well stand:

Not how skilful but how safe.

It is almost axiomatic that in technical skill practice indeed makes perfect. The axiom, however, is not always so evident in the matter of judgment, for here much depends upon individual powers of observation and upon that logical and judicial quality of the intellect which enables one to comprehend cause and effect. In following the course of a surgical disease with its multitude of complicated incidents the fitting together of related phenomena often enough becomes a task beyond the power of human mind.

Reviewing the causes of danger and of death in the operations of surgery we come upon three factors which are of paramount importance. These are the anæsthetic, the excessive loss of blood, and shock. Sepsis need not be here considered since, when directly due to the operation, it is after all a secondary and more avoidable source of peril; and when sepsis is present before the operation surgery is called in to overcome it.

We will first take up the matter of anæsthesia. It is quite certain that in spite of the utmost precaution a percentage of mortality is directly due to anæsthetic poisons. This is not denied by the most expert anæsthetists and, indeed, they are

* Read before the New York Surgical Society, October 13, 1909.

the very ones to sound the note of warning and to point out the necessity for care and experience in this branch of surgery. It follows, therefore, that in considering the dangers of any operation, the duration of anæsthesia as well as the variety and amount or dosage of the narcotic itself must be kept in mind. We must remember that the shorter the anæsthesia and the smaller the quantity of the drug used at one time the less will be the danger. If an operation promises to be of long duration, and if the saving of time is recognized as an important element, then we should consider the advisability of doing the work in two stages even though the total time of anæsthesia for the two stages be greater than that of the operation performed at one sitting. A quantity of narcotic may be taken with safety in divided doses which would surely prove lethal if taken at once.

Excessive Hemorrhage.—The acute anæmia resulting from loss of blood at an operation is a frequent source of great danger and of death. It is best to avoid even the near approach of peril and, whenever possible, to stop the operation when hemorrhage causes the patient's condition to become alarming. The observation of the blood pressure is of much value and the warning of the sphygmomanometer should not be disregarded. Better surely operate twice or three times with safety than take unwarrantable risk in order to finish at one sitting the work and perhaps the patient.

Shock.—Shock may be the result of hemorrhage, or it may be caused by manipulation of vital organs, or it may be the direct sequel of operations which have been unduly prolonged. Shock may be directly caused also by profound mental impressions attendant upon the scenes and experiences connected with operations even when performed without the aid of narcosis. Indeed, one of the greatest boons of anæsthesia is the doing away with the psychical as well as the physical impressions upon the patient during the progress of surgical work.

Reasoning from the foregoing statements, the conclusion is inevitable that the cause of safety in surgery will be distinctly

advanced, first, by using the smallest necessary amount of the anæsthetic; secondly, by avoiding excessive hemorrhage; thirdly, by shortening the actual time of operation.

For a number of years I have been convinced that one or another or all of these safeguards may be secured in certain operations by performing them in two or more stages. And, moreover, I would suggest that in planning any serious operation the possibility of the lessened risk by this method should be considered. When, for sound surgical reasons, the division of the operation has been decided upon, the wishes of the patient or his friends should be disregarded if a single-stage operation is urged in order to be through with a disagreeable experience. On one or two occasions I have regretted bitterly doing too much at one time, but I have never regretted dividing the operation.

I am well aware that many good surgeons will look with scorn upon this indication of apparent timidity, just as some regard the preliminary ligation of arteries as a confession of uncertainty in the technic of hæmostasis. What we are all working for, however, is to save the patient,—to jeopardize him as little as possible. Often an operator will consider a procedure safe for one subject but not for another. Quite true. Then why be more reckless simply because the individual may seem capable of enduring an exceptional strain? The certainty of *preserving life* is the most important reason for the existence of surgery, though we are not unmindful of the other great branch, namely, to render life more desirable.

In some operations the two-stage principle has long been recognized,—for example, in the older methods of performing cholecystostomy and colostomy. My plea, however, is for the more general acceptance of the doctrine in all operations which might be called extra hazardous and which, at the same time, lend themselves to a natural division into well-marked steps or stages. The tender-hearted person who could not cut off the dog's tail at once but who managed to accomplish the result by removing an inch at a time may have multiplied pain in his feeble-minded endeavor, but he uncon-

sciously subscribed to the theory well known to our forefathers in medicine, that the shock of an amputation increases in direct proportion to the proximity of the plane of section to the trunk of the individual.

In this paper I shall briefly discuss certain typical operations which appear to me particularly suitable for division into stages, but will not refer to those which from their very nature must occupy many sittings; such, for example, as complicated plastic work.

OPERATIONS WHICH ARE SUITABLE FOR DIVISION INTO TWO
OR MORE STAGES.

1. For intracranial disease.
2. For intrapulmonary disease.
3. For obstruction of the bile passages.
4. For obstruction at the pylorus.
5. For malignant disease of the rectum.
6. For hypertrophy of the prostate.
7. For suppuration in the kidney (nephrectomy).

Intracranial Operations.—Hartley has pointed out that infection in operations upon the cranial contents occurs in direct proportion to the necessity for drainage. It would therefore seem that except in cases in which infection previously exists complete closure of the entire wound reduces the danger of sepsis. It follows that in operations for intracranial growths, for neurectomy and in similar procedures, completion of the operation in one stage promises the best results. It must, however, be recognized that some of these operations are accompanied by such profound shock as demonstrated by lowered blood pressure, whether due to hemorrhage or to interference with the vital centres, that completion of the operation signifies unwarrantable risk. If the work has been well planned, so that it may cease at any moment, the operation can be stopped, the wound *completely* closed and the patient sent back to bed to await reestablishment of his equilibrium. A second or even a third sitting is then to be re-

garded as a separate operation. The danger is thus safely distributed so far as shock is concerned, although it is naturally doubled or trebled in regard to the more avoidable accident of sepsis.

Operations upon the Lungs.—In the absence of apparatus for pneumatic differentiation, the extirpation of tumors of the lung and the evacuation of pulmonary abscesses, as well as cutting operations for the removal of foreign bodies, can be performed best by the two-stage method. The first step is for the purpose of accomplishing the local adhesion of visceral and parietal pleura, either by means of suture or by the formation of aseptic inflammatory exudate such as that following the application of zinc chloride solution to the unopened parietal pleura. The adhesion gives us a field for performing the pneumotomy proper without the risk of the septic invasion of the entire pleural sac. And, indeed, it is probable that even with the help of apparatus for negative or positive pressure septic work on the lung will be less dangerous if the operation is divided. The pleura is extremely subject to acute spreading infections from very slight unsterile trauma. Then, too, we have here the added risk of pneumothorax.

Operations for the Relief of Biliary Obstructions.—In prolonged icterus, especially when there are cirrhotic changes in the liver, even slight operative interference is apt to be followed by fatal recurrent or secondary hæmorrhagic oozing. To be sure, a few precautions may be taken to shorten the coagulation time of the blood,—such, for example, as the injection of alien serum before the operation. From personal experience, however, I am of the opinion that in operations of magnitude the danger of hemorrhage continues long after the good effects of the alien serum have disappeared. The safer mode of procedure, then, when deep chronic jaundice is present, is to employ serum or other therapy and to operate by the shortest and simplest possible method merely for the relief of cholæmia, reserving the removal of the cause of obstruction until a later operation.

My practice is to perform cholecystostomy for drainage

and to do this in one stage through a small incision; and to avoid all unnecessary irritation of peritoneum whether by handling or packing. When the patient is in very poor general condition and when the obstruction partially yields after the cholecystostomy, as evidenced by the presence of bile in the stools, there is no reason whatever for hastening the second step. In the case of very old persons or those who have shown that they bear operations badly, it is best to continue biliary drainage indefinitely or even permanently. For this purpose I use a little flexible solid rubber plug with a core of copper wire which permits the plug to retain any desired curve. At the distal extremity of the plug there is a thin pliable flange about two inches in diameter, which neatly adapts itself to the curve of the abdominal surface. About a half inch from the flange there is a bulbous enlargement of the stem which fits so firmly in the sinus itself that no bile or other discharge can escape. The diameter of the stem is about 14 to 16 French scale and the bulbous portion is two sizes larger. The total length of the appliance must depend upon the distance of the viscus to be drained from the abdominal wall—considerably greater in obese than in emaciated persons. The plug may be held in place by a strip of adhesive plaster and its presence is not a source of discomfort. It may be removed and cleansed once a day and in the event of a colicky attack due to closure of the cystic or common duct relief will be at once experienced on removal of the plug. I have patients who have been comfortable for years with simple drainage, preferring the condition to the dangers of a radical operation.

Pylorotomy.—It appears to be pretty clearly proved that the safest method for performing this operation is by a combined extirpation of the pyloric region of the stomach and duodenum with complete closure of both open ends, followed by a gastro-enterostomy to act as an artificial pylorus.

It has been the custom to perform both these operations at one sitting. I would suggest, however, a plan which I have tested and will certainly make my rule, namely, to divide the operation. The advantages are several. The first and

most important one is that in starved and emaciated persons the short and simple gastro-enterostomy is followed by an enormous improvement in the general nutrition and in strength, so that the pylorectomy itself becomes a far less shocking operation than it would have been without the preliminary step. Then, too, the second operation is often considerably shortened and is rendered easier by the subsidence of inflammatory thickening and adhesion about the neoplasm. I have seen a tumor the size of a large duck's egg disappear *completely* in the two weeks following gastro-enterostomy. At the second laparotomy the parts were carefully examined and not a trace of tumor or adhesion could be found, so the proposed pylorectomy was for the time abandoned, the patient being warned to report at once any symptoms of relapse. Naturally, this tumor could not have been neoplastic, but it was probably inflammatory due to the threatened perforation of an ulcer. If I had a similar case to treat I would remove the pylorus in any event.

Extirpation of Malignant Growth of Rectum.—With preliminary colostomy for exclusion of the rectum the symptoms due to the continued functioning of the diseased organ are greatly ameliorated. Also the general condition of the individual thus relieved becomes so much improved that extirpation of the tumor or amputation of the rectum by any method becomes a good surgical risk, whereas before the colostomy the danger might have been prohibitive. At the same time, the preliminary abdominal section will afford a good opportunity for the examination of the upper limits of the neoplasm and the adjacent organs, so that the advisability of the radical operation as a further step can be determined. A year or two of life is far preferable, surgically speaking, to a death resulting from an attempted radical cure. I have more than once had occasion to note both the advantageousness of the preliminary colostomy and the unfortunate results of the attempted extirpation of an inoperable tumor without preliminary colostomy.

One case impressed me profoundly. It appeared to be a

simple matter to remove a non-adherent tumor situated high in the rectum but demanding resection of bowel. A laparotomy for colostomy revealed numerous unexpected metastases, some of which were in the liver,—a condition which would have rendered any operation of greater magnitude a surgical crime.

Suprapubic Prostatectomy.—It is not my purpose to enter here upon a discussion of the various routes of approach. My personal opinion is, as stated elsewhere, that the suprapubic is the preferable operation in the vast majority of instances. One of the most cogent reasons for advising this route is that it lends itself ideally to the two-stage operation. Even in the feeblest individuals the opening of the pneumatically distended bladder with the aid of local anæsthesia is an extremely short, simple and safe piece of work. We are then in a position to understand fully the exact conditions which cause the obstructive symptoms, and we may also explore, by sight if desired, the entire vesical wall including the ureteral and urethral orifices. Diverticula, tumors, and calculi—whether encysted or not—will be discovered. They may be dealt with at once or later, or not at all. Whether or not there is infection causing cystitis the troubles caused by the distressing periodic attempts to empty the bladder are done away with at once. Knowing that we are to have the opportunity of this surgical and exact exploration it is unnecessary to do a preliminary cystoscopy, often in these cases a painful and even dangerous procedure.

Shock following cystostomy is extremely rare. The patient is out of bed the following day and may even be permitted to be upon his feet for a few minutes at a time. The second stage of the operation, enucleation of the prostatic growth, need not be undertaken until the patient's condition has so far improved that he can with reasonable certainty bear a general anæsthesia of from five to ten minutes.

Many of these patients being affected with arteriosclerosis are apt to bleed, and if the operation has been done in two stages great embarrassment may be avoided, since the surgeon

will know the exact location of the hemorrhage. After the first stage this will be in the abdominal part of the wound. After the enucleation any bleeding which occurs will almost invariably come from the prostatic wound. When the work is done in one stage there are two places which may be expected to bleed, and the determination of the location of the hemorrhage is always troublesome, often difficult, and sometimes necessitates another anæsthesia,—surely a disquieting and frequently a dangerous proceeding.

Should we be unfortunate enough to lose the patient after the cystotomy it is mathematically more probable that he would have succumbed after a cystotomy *plus prostatectomy*.

These are the most important advantages of the operation of suprapubic prostatectomy in two stages. All the good points of the suprapubic route need not here be enumerated.

Nephrectomy for Renal Suppuration.—Removal of the kidney weeks or months after surgical drainage of the organ is usually difficult and dangerous because of dense adhesions to neighboring important structures. Indeed, secondary nephrectomy is so fraught with peril that many surgeons rate its mortality many per cent. higher than that of the primary form of the operation. Yet the removal of a large pus kidney with the flooding of the great fresh wound with enormous quantities of septic fluid is an extremely serious matter and is usually accompanied by great hazard.

Now, if we content ourselves with an ample incision for drainage and exploration, it will be noted that at the expiration of a week the sepsis will have become less severe, the tumor mass will have greatly diminished in size and nephrectomy may be quickly and easily performed, the entire operation consuming, say, from five to ten minutes. The adhesions, instead of being tough and fibrous, as they would have become with several weeks of delay, are succulent and easily separated with very little hemorrhage.

I have carefully tested this method and can report conscientiously that the danger of the double anæsthesia is not to be considered in comparison with the added factor of safety.

Also, that there is a decided shortening of the total duration of the operation.

In conclusion, permit me to call to your attention two valuable points in operative surgery: First, arrange the operation whenever you can so as to permit cessation of the work at any moment. Second, get through with the essential part of the operation early, so that if you must stop the patient will have been relieved.

THE EFFECT OF SCARLET RED, IN VARIOUS COMBINATIONS, UPON THE EPITHELIATION OF GRANULATING SURFACES.*

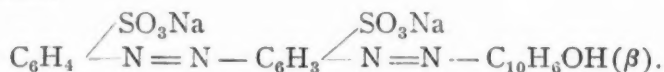
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THIS paper has as its basis the observations made during the treatment of 60 cases with scarlet red.

Chemical Structure.—Scarlet red, or Biebrich's scarlet red, was discovered in 1882, and is an anilin dye which stains silk and wool a brilliant scarlet color. It is a disulphonic acid derivative, and the dye on the market is the sodium salt of the staining acid, and is in the form of a powder. It is made from diazoazobenzoldisulphonic acid and β -naphthol and has the formula,



Experimental Use of Scarlet Red.—Fischer, of Bonn, in his paper on "Experimental Generation of Atypical Epithelial Proliferations, etc.," published in 1906, called attention to the fact that when a saturated solution of scarlet red in olive oil was injected subcutaneously, an inflammatory condition was produced, and there was also an increase of mitosis in the germinal layer of the skin, as well as in the hair follicles and skin glands. He was able to produce this proliferation only in the skin, and from this was led to believe that scarlet red acted as a specific attraxin upon the surface epithelium. He found that the new formation of epithelium caused by the injection of scarlet red oil, which very markedly resembled skin carcinoma, showed no tendency for independent after-

growth, and kept up only as long as the injections were made. When these were discontinued the new formation retrograded and degenerated into epithelial pearly bodies. This suggested to him that it might be used therapeutically.

Helmholz, in 1907, was able to produce similar epithelial proliferations in the skin, and in addition succeeded in creating a like growth in the mouth and rectum. He thought that, with the technic as finally developed, he could get the same results in the stomach, intestines, etc. The positive results in the mucous membranes of the mouth and rectum would rule out the idea of Jores that the presence of hair follicles was necessary.

Helmholz found that there must be close contact between the scarlet red oil and the epithelium, in order that any reaction take place. He believed that scarlet red could hardly be claimed as a specific attraxin, but rather something that by interaction with the connective tissue produced a soil that was ready for epithelial development. He also showed that the cylindrical epithelium in these experimental tumors remained so only as long as it lined a lumen, and when it formed in masses it changed to the squamous type, and just as readily returned to the cylindrical type when lumina formed in the epithelial masses. This metaplasia showed how different the process was from carcinoma, in which the character of the cells remains constant.

Werner, in 1908, found that concentrated scarlet red oil injected into mice carcinomata stimulated the growth only while the injections were continued, and from his experiments came to the conclusion that the proliferation was not a chemotactic influence on the cells, but occurred through the irritation of the same.

The above brief mention of the action of scarlet red oil, when injected subcutaneously, will give an idea of the theories brought forth as to the cause of the epithelial proliferations. I shall not discuss their relative merits here, but will simply take up the clinical results obtained by the local application of scarlet red, in various combinations, on granulating wounds,

in order to hasten epitheliation. From the experimental work mentioned above, and from the results of the therapeutic action so far reported, it seemed perfectly safe to use scarlet red externally for therapeutic purposes, without danger of producing carcinoma. My own investigations have, so far, confirmed me in this belief.

The only literature on the therapeutic use of scarlet red is as follows: Schmieden was the first to apply Fischer's suggestion, and published a paper on "Epithelial Growth under the Effect of Scarlet Red" early in 1908. Kaehler, in May, 1908, and Krajca, in September of the same year, and also Cernezz, in February, 1909, published enthusiastic articles on this subject, with modifications of Schmieden's technic. Wolfrum and Cords, in February, 1909, reported favorable results on corneal ulcers with scarlet red salve.

Being stimulated by these papers, and having an opportunity to treat and observe a number of granulating wounds in the Surgical Outpatient Department of the Johns Hopkins Hospital, I began a series of experiments with the scarlet red. A few of the cases thus treated were house cases in the Johns Hopkins Hospital and at the Union Protestant Infirmary, but the greater number were those in the Outpatient Department. These cases were not selected, and the wounds for the most part were very unsatisfactory to start with. Many were chronic ulcers of various varieties, belonging to the class of wounds upon which Schmieden stated the treatment with scarlet red was useless. A large number of these patients continued their daily occupations, and thus the factors of rest and regular attendance could not be counted on. In fact, a more severe test of a treatment could scarcely be applied.

The dye employed was that manufactured by the Badische Company of Ludwigshafen, Germany, which is sold in one pound cans, and is inexpensive. In the experiments, I have used 2, 4, 5, 8, 10, and 20 per cent. scarlet red ointments, with a simple vaseline base. As I have been unable to observe any especial antiseptic properties in scarlet red, I had the following antiseptic ointments of U. S. P. strength made up in

vaseline, and containing 8 per cent. scarlet red; boric acid; zinc; iodoform; blue ointment; and an ointment consisting of one drachm balsam of Peru to one ounce of vaseline. On several occasions I have dusted small wounds with the pure powder.

The ointments were prepared by rubbing up the scarlet red with a small amount of olive or castor oil, until a smooth mass resulted, and then this mass was thoroughly mixed with the base. Sterilization of the ointment caused the color to become somewhat darker, but this change did not seem to affect the stimulating power of the preparation.

Technic.—Clean, healthy granulations should be bathed with boric acid solution and dried. Should the granulations be unhealthy, peroxide of hydrogen is used in addition before the boric acid solution. I have found it best not to use bichloride of mercury or other strong antiseptic solutions on the wound before treating it with the scarlet red. Free use of nitrate of silver stick is advisable to keep down exuberant granulations. The skin surrounding the defect should be anointed with some bland ointment up to within 1 cm. of the edge. Since this has been done the irritation complained of in some of the early cases has been, to a large extent, eliminated.

The ointment may be applied over the whole surface of the wound if it be small, or simply to the growing epithelial edges. Whichever method is chosen it is best to apply the ointment on perforated old linen, to which the granulations will not adhere, and which allows the escape of secretions and thus prevents maceration. When applied to the edges, the old linen should be used in narrow strips covered with a thin layer of the ointment. I prefer the old linen to the rubber protective advocated by Cernezz, as it is less macerating.

Another very satisfactory method is to apply a thin coating of the scarlet red ointment to the wound edges with a camel's-hair brush, being sure that the edges are dry. Then either cover with strips of old linen, or expose to the air. This is especially useful in the partial graft cases and on small wounds.

as the ointment can thus be accurately placed and the amount regulated. The portions of the wound not covered by scarlet red may be dressed as seems best, or may simply be exposed to the air under a cage.

A light dressing of sterile gauze secured by a bandage completes the procedure. This dressing should be removed within forty-eight hours, twenty-four-hour intervals being preferable, and replaced by some bland ointment, such as zinc or boric acid ointment. After the same interval has elapsed the scarlet red dressing should be replaced. The importance of careful dressing is to be emphasized, as in some cases severe irritation has followed the improper application of the dressing. It is well to warn patients that the ointment may stain the dressing red, as several have returned much frightened, saying that the wound had been bleeding.

Cases Treated.—There were 60 cases treated, of whom 44 were males and 16 females. The youngest was 2 years old, and the oldest 76 years. White, 46; colored, 14. *Duration of the lesions*, a few days to 15 years.

The cases were grouped as follows:

Partial skin grafts,.....	7
Ulcer following operation for infection,.....	10
Ulcer following burn,.....	11
Traumatic ulcer,.....	10
Specific ulcer,.....	8
Varicose ulcer,.....	7
Ulcer following Cotting operation for ingrown toe nail,...	3
Bedsore,	2
Miscellaneous ulcer,.....	2

The general health of the patient seems to have some bearing on the stimulating effect of the scarlet red, which is distinctly less marked in nephritic and diabetic cases. The age, on the other hand, has little or no effect; for instance, the measured growth on one patient 76 years old was 3 mm. in 48 hours; and in another 67 years old, there was a growth of thick epithelium 4 mm. wide in 48 hours (Figs. 1 and 2). As we seldom have two lesions of exactly the same size on the same person, it is difficult to make an accurate comparison

FIG. 1.



Traumatic ulcers, 11×5 cm. and 5×2 cm. Age of patient, 76 years. Duration, 3 months. (A) Taken January 27, when treatment was begun. (B) Taken March 22.

FIG. 2.



Ulcer following operation for infection of forearm and wrist. Largest diameters 15×5 cm. (A) Taken January 27, when treatment was begun. (B) Taken January 29. The stimulation of the epithelial edges is well shown in this picture, and measures 4 mm.



Multiple specific ulcers on outer side of leg of negro. Duration over one year. Ulcers, when treatment was begun. (B) Taken December 9. (C) Taken February 4, 1909.



Varicose ulcer, 15×9 cm. Duration several months. (A) Taken October 16, 1908, when treatment was begun. (B) February 10. A to C show the stimulation of the lower left-hand portion of the ulcer.



year. Ulcers, 4×2 cm., 6×4 cm., 8×3 cm. (A) Taken November 25, 1908. February 4, 1909. Note return of pigmentation in newly formed skin (C).

FIG. 4.



not was begun. (B) Taken November 18. (C) Taken December 18. (D) Taken January 2, 1909. (E) Taken and portion of the skin edge. Note return of pigment in new pink skin in E.

FIG. 5.



Ulcer following excision of epithelioma, 6×5.5 cm. Bone exposed. (A) Taken January 11, when treatment was begun. (B) Taken March 17. Difficult to make out edges of the scar.

between the rapidity of healing of a wound treated with scarlet red and one treated with the ordinary methods. However, on one patient there was an ulcer 3.5×3 cm. on each leg, and the one treated with scarlet red healed three weeks before the other, which was treated in the usual way. The difference in the appearance of the newly healed area was very marked, that following the scarlet red being thick, firm, and so much like the normal skin that it was difficult to make out the original outline of the ulcer, while the usual sharply defined scar marked the location of the other ulcer. In many cases there is undoubtedly a very marked stimulation of the epithelial growth, and, taking the results as a whole, while personal supervision in this series in connection with careful dressing is a factor which must be considered, one would hardly feel justified in attributing the success of the treatment entirely to this supervision.

The rapidly growing epithelium is thick and at first a bluish-red with an opalescent spreading edge. Venules of considerable size can be seen close to the surface. The color and the enlarged vessels soon disappear, however, and the newly formed tissue rapidly assumes the color and characteristics of the normal skin. A section through an area thus healed shows practically normal skin. As a rule, after a short time this skin becomes freely movable over the underlying tissues.

In several instances the patient did not return for from 5 to 16 days after dressing with scarlet red, and it was noted in two of these cases that where the granulations had been exuberant on small ulcers, a cone-shaped mass of epithelium covered these granulations. This projection soon disappeared and the epithelium assumed the level of the surrounding skin. No apparent bad effect resulted from the prolonged exposure to scarlet red in these cases, except that a grayish membrane formed over the granulations, which could be stripped off and the healthy granulations exposed. It is needless to say that there was no irritation in this group of cases. The grayish membrane over the portion of the granulations covered with scarlet

red will often form within 48 hours, and can be easily lifted off.

The method of pigmentation of the newly formed pink skin on negroes is interesting. Within a short time the sharply defined edges of the normal skin become wavy, and streaks of pigment project from it (Figs. 3 and 4). Here and there in the pink skin isolated patches of pigment appear, some of which are several centimetres from the pigmented skin edge. This seems to show that the pigment is derived from the deeper tissues, as well as from the skin edge. The pigment spreads from these patches also, and the entire area becomes dusky and later assumes the color of the neighboring skin.

The sensation of the newly formed skin begins at the margins and gradually spreads towards the centre. This is similar to what occurs in skin grafts, the nerve supply coming from the edges of the wound and not from the underlying tissues.

On those wounds which heal and then break down, because of the unstable condition of the epithelium, scarlet red has been useful; for example, a superficial ulcer following a burn on the front of the ankle and entire dorsum of the foot had nearly healed several times, and then completely broken down again. Treatment with scarlet red ointment was begun on December 26, 1908, and the healing was complete and all dressings were omitted on January 8, 1909, since which time the patient has had no further trouble, as the wound is covered with thick stable epithelium.

Scarlet red should not be used on burns until the irritation has disappeared, and the granulations are well established.

The exact strength and combination of the ointment to be used on different types of wounds can hardly be dogmatically stated, as experience is necessary for this knowledge. However a few general observations may be of advantage. The 8 per cent. ointment is used unless especially contraindicated. In some cases which were sluggish to the 8 per cent., the 20 per cent. ointment has caused rapid stimulation of the edges. I should not advise the constant use of the 20 per cent. strength, as on several occasions it has proved too irritating

in spite of all precautions. It is of value now and then, although its action should be carefully watched.

On several wounds which were nearly closed, the pure scarlet red powder was dusted on the uncovered area, after protecting the surrounding skin. It had a marked drying effect and caused no irritation.

When the wounds are covered with unhealthy granulations and the discharge is profuse and foul smelling, I have found the scarlet red in iodoform ointment, or balsam of Peru, or blue ointment very efficacious in cleaning up the granulations and at the same time stimulating the epithelial growth.

As an example of the unfavorable type of wounds treated, I will mention an extensive multiple leg ulcer of five years' standing, which was covered with maggots when the rags with which it was wrapped were removed. This was cleaned up and dressed with scarlet red and within 48 hours there was a definite stimulation of the epithelial edges, and uneventful healing later. It is interesting that this patient came to the Dispensary because he had mashed the tip of his little finger, and not for the leg condition, which he had been taking care of at home.

A number of large specific ulcers having a duration of from three months to five years, which had not responded to constitutional or local treatment, were stimulated markedly by scarlet red. Although they were among the most unfavorable-looking ulcers, the healing was prompt and lasting. In the specific cases constitutional treatment was of course continued. Several of these ulcers were very sensitive, and the patients volunteered the statement when returning for dressing that the "red salve" gave them more comfort than any dressing they had ever had. This seems a curious fact, inasmuch as scarlet red had an irritating action on some other cases, and caused pain and discomfort. Scarlet red in blue ointment is especially useful in treating specific ulcers.

There is a difference in the degree of stimulation caused by scarlet red on the epithelial edges of the same wound at different times. I have also noted that in several cases one portion

of the growing edge was markedly stimulated while the remaining portions were only moderately so.

The skin formed under scarlet red seems to fill the place of the missing skin, somewhat like a whole-thickness graft, and in only one case has there been any tendency towards cicatricial contraction. This case, a burn of the neck and chest, was treated in the hospital by the usual methods for some time before scarlet red was started. Several weeks after healing the patient returned with a small contracted band of scar tissue on the left side of the neck. She was advised massage, and told to return if the condition continued.

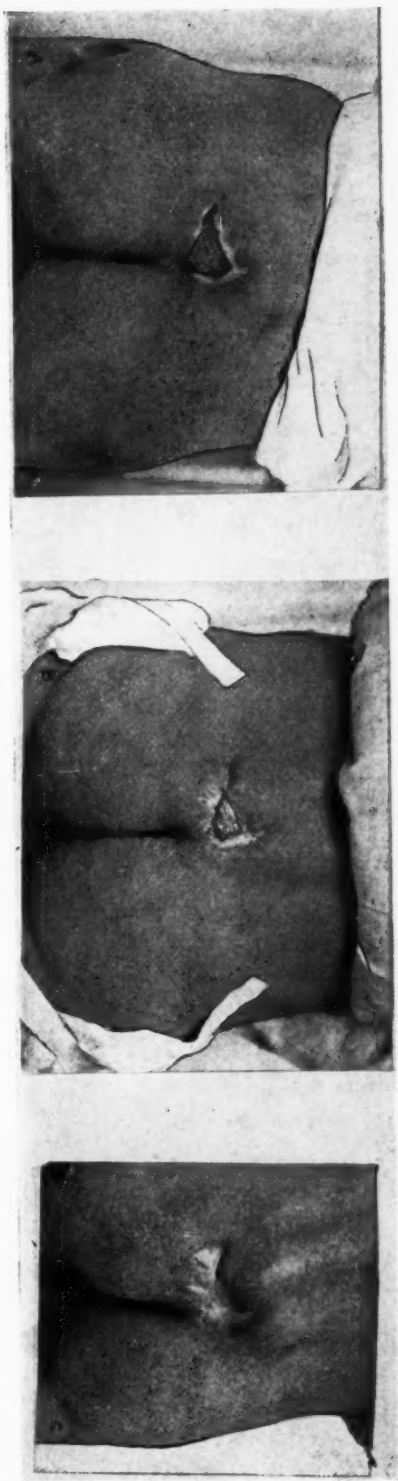
Several varicose ulcers were treated with scarlet red without a pressure bandage, in order to test the efficacy of the healing, and there was no diminution noted in its rapidity or character.

Ulcers following the Cotting operation for ingrown toenail are usually sluggish and heal slowly, but with scarlet red the healing is materially hastened.

In an ulcer following the excision of an epithelioma of the face, there was a recurrence in the lower angle of the wound three weeks after operation. The ulcer had been treated once with scarlet red, only two days before the recurrence was noted, so I do not consider that the scarlet red was in any way responsible for the recurrence (Fig. 5).

I have been able to try the effect of scarlet red on an autodermic and isodermic partial Thiersch and whole-thickness grafts, and also on zöodermic (dog) grafts. All of the seven cases which were grafted had very extensive lesions, and several partial grafts were placed on each of these at different times. The wound edges and also the edges of all these types of grafts were markedly stimulated. Scarlet red, 8 per cent., if applied to the surface of a Thiersch graft within four days after transplantation, causes maceration of the surface. In order to avoid this I find it advisable to apply the scarlet red, in from 4 per cent. to 8 per cent. strength, to the edges of the graft alone, and not until ten days have elapsed. Only the edges of whole-thickness grafts should be covered with scarlet

FIG. 6.



Bed sore following typhoid, 3×5 cm. Duration several months. (A) Taken November 6, when treatment was begun. (B) Taken November 18. (C) Taken December 7.

FIG. 7.



Ulcer following injury, with subsequent deep infection. (A) Taken December 4, when treatment was begun. (B) Taken December 14.



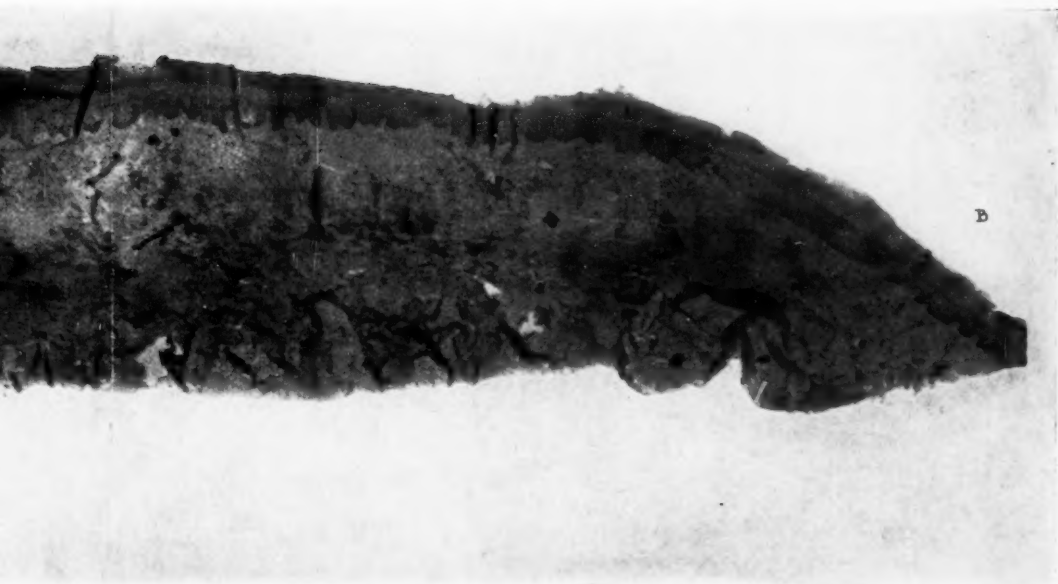
Section of negro skin, formed under Scarlet Red treatment, on a chronic varicose ulcer of the leg. The epidermis is thickened, and the stratum Malpighii is deepened. At B the papillary formation is not especially noticeable, but at A the papillary formation becomes more marked. All the layers of the epidermis become much thicker, and under high power

FIG. 8.



A small portion of Fig. 9 under higher magnification. Note the papillary formation and the thickness of the stratum Malpighii. The masses of pigment cells in the deeper layers of the skin are interesting from the fact that the newly formed skin is pink and shows no pigmentation, while in certain portions of the section, where it passes through an isolated pigmented spot in the pink skin, there seems to be a definite relationship between the pigment in the deeper layers and that in the cells of the stratum Malpighii.

FIG. 9.



eg. The end A is 2 mm. from the growing epithelial edge. The end B is a portion of the normal surrounding skin and shows noticeable and the stratum corneum and Malpighii are about normal thickness. As we follow the surface toward A, the papillary high power intense cell division can be seen

FIG. 10.



Ulcer following operation for infection, 9×3 cm. Duration, 1 month. (A) Taken December 30, 1908, when treatment was begun. (B) Taken January 8, 1909. (C) Taken January 15. Measure on final healing, $6, 8 \times 1.5$ cm.

red, unless the superficial layers are cast off, in which case the whole surface of the graft should be covered, as it will hasten the "topping" of the graft with epithelium.

Wolfrum and Cords report favorable results with 5 per cent. scarlet red ointment on corneal ulcers.

My experience with scarlet red on mucous membranes has been confined to pieces of vaginal mucosa transplanted to granulating wounds. The edges of these grafts were stimulated; also, the defect left by the removal of sections for examination healed under scarlet red very rapidly. From the above experience I have no doubt but that this method of treatment can be utilized with advantage on mucous membranes which can be kept reasonably dry.

It is an interesting fact that the scarlet red is absorbed and then excreted by the kidneys. This has been noted in a number of cases; for example, a large ulcer of the chest, following a burn, was dressed with scarlet red, 8 per cent., at 1.30 P.M. December 13, 1908. The urine voided at 2.10 P.M. was amber clear; at the next voiding at 9.30 P.M. it was a bright scarlet; December 14, at 2 A.M., still a bright scarlet; at 8.10 A.M. it was a pale red; at 11.25 A.M. still a pale red; at 1.30 P.M. the scarlet red was removed and the wound was dressed and irrigated. At 2.15 P.M. the urine was a reddish amber; and so on until 8.30 A.M., December 15, when it was a pale pinkish color; after this the urine resumed its normal amber color. There is no undue stimulation of urinary secretion, and except for the color the constituents of the urine are unchanged. The other excretions were apparently unaffected.

There was severe irritation in ten cases, eight of which were not permanently helped by the treatment, although there was stimulation of the epithelial growth in all but two cases. Most of these cases were those treated early in the series, and since better technic has been employed no severe irritation has occurred. However, in sixteen other cases there was a slight reddening of the surrounding skin accompanied by a burning sensation at some time during the treatment, although this in no way interfered with the ultimate result.

In several instances scarlet red had to be discontinued on account of the pain and irritation caused by it. This was espe-

cially noticeable in women and young children. In the case of a child two years old, with an ulcer following a burn of the axilla, the irritation of 5 per cent. scarlet red ointment was very marked. Following a second application of the ointment there was a sharp attack of erysipelas. Cultures from the ointment were negative, and as there had been no case of erysipelas in the hospital for some time it is likely that the irritation produced a favorable condition for the infection.

In a case of varicose ulcer of which the duration was ten years, and where the skin was particularly sensitive to scarlet red, there was a definite phlebitis of several veins in the neighborhood of the ulcer after the third dressing with scarlet red, and it seems probable that the irritation caused by the scarlet red might have extended into some of the superficial varicose veins. This patient became very ill and was admitted to the hospital. He ran a high temperature for about ten days, which was suspected to be due to typhoid infection, but this was not proved, and about three weeks later he was discharged from the hospital, the phlebitis having cleared up perfectly.

In a tuberculous ulcer of the groin of eight months' duration, measuring 8 x 10 cm. and having undermined edges, scarlet red was tried and very markedly stimulated the epithelial growth. It was quite remarkable that the new thick epithelium started beneath the undermined edges, and for a time these edges overlapped the new epithelium slightly, but were finally absorbed. This ulcer healed rapidly with firm healthy skin until 1.5 x 2.5 cm. remained uncovered, then suddenly without any apparent cause the ulceration began again here and there on the edges and in the new skin. On the continuance of the same treatment the ulcer finally healed completely, and as yet shows no tendency to break down.

Where tight pressure bandages are applied over scarlet red, there is more likelihood of irritation. There have been several cases in which there was marked stimulation of the epithelial edges at the beginning of the treatment, but later just as marked deterioration. This was the case especially when the attendance of the patient was irregular, and in such instances the treatment with scarlet red was discontinued.

In one case where a patient with a varicose ulcer stayed away from the Dispensary for five days with the scarlet red dressing,

the irritation of the surrounding skin was so intense that a breakdown was feared. This fortunately did not occur.

The skin over old scar tissue is apparently much more easily irritated than ordinary skin. The stability, thickness, and normal appearance of the healing under scarlet red is noteworthy, and even if the healing in some few instances is no more rapid than that under the ordinary methods, these advantages would seem to make it worth while (Figs. 6, 7, 8, 9, and 10).

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CHLOROMA OF THE JAWS.*

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CHLOROMA is such a rare condition that the following case should be of some interest.

M. B., an Englishwoman aged 38, who was married and had three children, and had resided in Canada during the previous three years, came to the surgical out-patient department of the Toronto General Hospital on February 12, 1909, where she was seen by Dr. W. Warner Jones.

About January 5, 1909, she suffered from violent neuralgic pains over the temporal region, cheek and upper jaw on the left side, and then first noticed a swelling of the gum of the upper jaw in the region of the first bicuspid tooth of the left side. A day or two later she noticed a similar swelling at a corresponding point on the opposite side, and simultaneously a swelling made its appearance around the first bicuspid of the lower jaw on the left side. Within a day or two the pain subsided, but the swelling continued to increase.

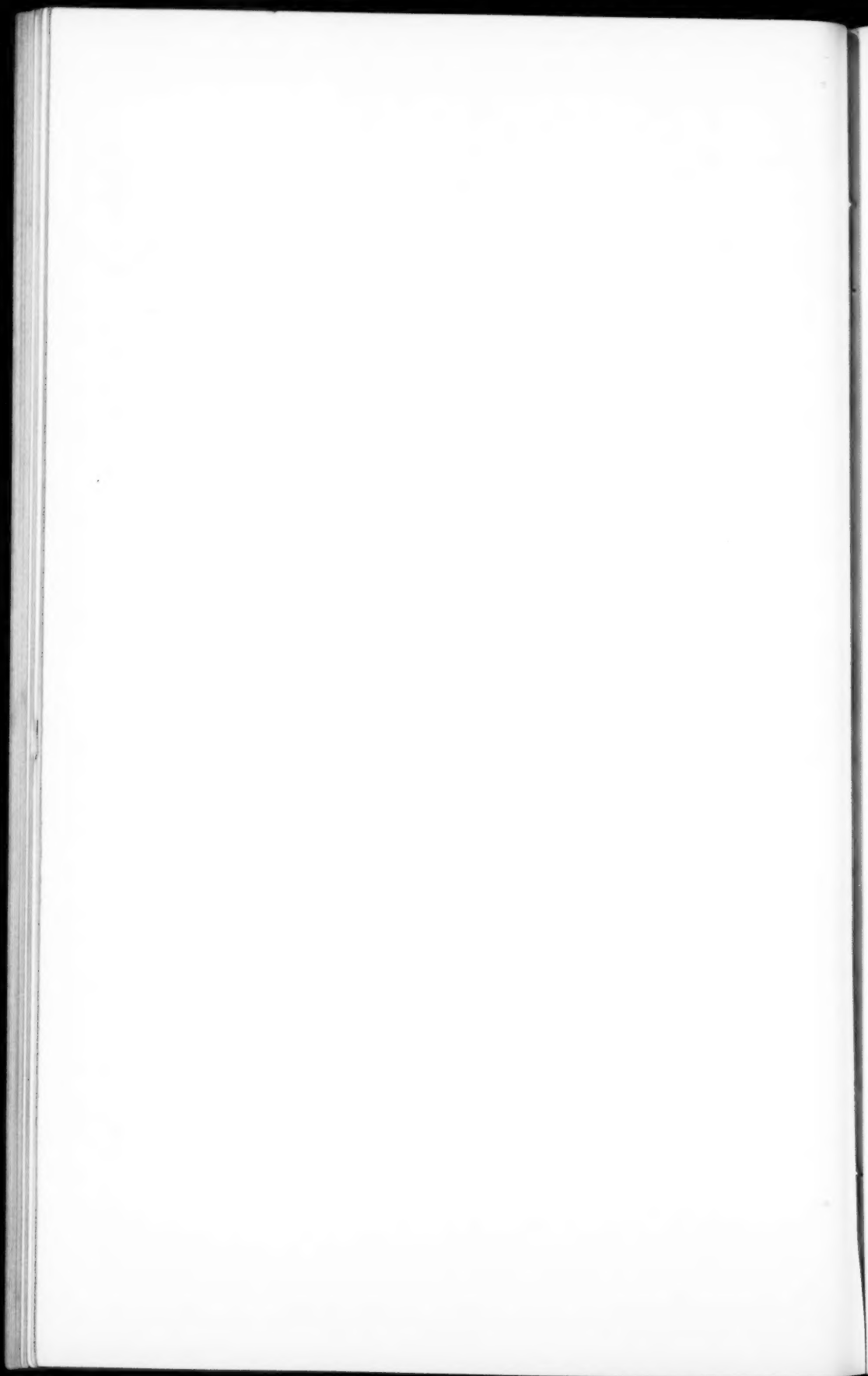
February 12. On examination a marked swelling of the gums is seen involving both jaws on the lingual and buccal aspects, except on the right side below, where the teeth are absent but for one or two roots. There are swellings under the jaw on both sides involving the sublingual and submaxillary lymphatic glands. The glands are fairly movable and not tender to touch. No other glands enlarged in the neck. The skin is swarthy but no pigmentation. The breath is very foul. The eyes are large and prominent, but she says they have always been so. Her vision is good, and there is no squint and no exophthalmos. The teeth are all in line and not loose. The swelling of the gums is very marked, spreading between the teeth, convoluted, dark purplish

* Read before the Surgical Section of the International Medical Congress, Budapest, August 30, 1909.

FIG. 1.



The growth in connection with the jaws.



red in color, covered with epithelium, firm to touch, and not bleeding readily. The tonsils not enlarged. Temperature 99.6.

February 16: There is now ulceration and sloughing over the first right molar above. A piece was cut out for examination, and the pathologist reported that it was probably a lymphosarcoma. A blood smear was made and stained, and showed a slight increase in the white cells. A differential count showed: Polymorphonuclear neutrophils, 42 per cent.; small mononuclear lymphocytes, 12 per cent.; large mononuclear lymphocytes, 41 per cent.; eosinophiles, 5 per cent. The blood platelets were much decreased.

About three weeks later, March 8, a firm ridge about the size of a whip cord could be seen, running all round the jaws above and below, just at the junction of the cheek with the gums. The breath was very foul and there were one or two sloughing areas. Some of the teeth were loose. The pulse was rapid and the temperature was 102°.

She entered the hospital on March 12, under my care, and for the next ten days had a typical septic temperature, running from 100° to 104°, while the pulse rate varied from 110 to 140. The swelling on the left side of the neck rapidly increased in size, as also did the growth in connection with the gums. The breath was very offensive, there was much salivation and she was going down hill very rapidly. Pus was exuding from around the teeth and gums; it was thought that absorption of this pus was responsible for her temperature.

At the urgent request of her friends and the family physician an operation was undertaken, with the object of not only removing the growth but of getting rid of the septic condition around the growth and teeth and stopping absorption. She survived the operation only a few hours—dying March 23, 1909.

PATHOLOGICAL REPORT, by O. R. MABEE, M.D., Assistant Pathologist to the Toronto General Hospital; Demonstrator in Pathology, University of Toronto.—The following report is based upon the examination of tissue removed at operation and upon the autopsy findings. The tissue removed at operation consists of several irregular convoluted masses purplish grey in color, and several molar teeth, to some of which are adherent masses of similar tissue. This tissue is fairly firm in consistence and its surface smooth except for a few small superficial ulcerations. On section it is light greenish grey in color.

AUTOPSY, March 24, 1909.—The permission for autopsy was limited

to the examination of the organs of the body. Body is that of a well-developed and well-nourished adult white female. The pupils measure five millimetres and are equal. There is no exophthalmos. The cervical glands are enlarged on both sides. The axillary and inguinal glands are palpable.

Peritoneal Cavity.—Its surfaces are smooth and glistening throughout. The retroperitoneal and lumbar glands are moderately enlarged, varying in size from 0.5 to 2 centimetres in length. On section they are moderately firm and greyish in color. The mesenteric nodes are normal. There are several pin-point hæmorrhagic areas scattered throughout the visceral peritoneum.

Pleural Cavities.—Their surfaces are smooth and glistening throughout.

Pericardial cavity contains about 25 cm. of clear fluid. Its surfaces are smooth and glistening throughout.

Heart.—Weight 280 Gm. The myocardium is fairly firm in consistence and reddish brown in color. The endocardium and heart valves are normal. Coronaries normal.

Lungs.—Crepitation is present throughout. On section they are generally salmon-pink in color, irregularly mottled by black coal pigment. The bronchi and bronchioles contain a moderate amount of frothy blood. Bronchial nodes—normal in size and black in color.

Spleen.—Weight 165 Gm. Its capsule is smooth. On section it is reddish grey in color. The malpighian bodies and trabeculæ are normal. No pulp on scraping.

Gastro-intestinal.—Normal. Pancreas—normal.

Liver.—Weight 1600 Gm. Its capsule is smooth. On section it is reddish brown in color and fairly firm in consistence. The lobules are easily visible. Gall-bladder and ducts are normal.

Kidneys.—Weight 320 Gm. The capsule strips easily and leaves a smooth surface. On section the cortex averages 5 mm. and is greyish white in color. The glomeruli are visible as glistening dots. The pyramids, pelvis, and ureters are normal. Adrenals—normal. Bladder—normal.

Genital Organs.—External genitalia, normal.

Uterus is slightly enlarged. On section its mucous membrane is deep red and has a small amount of clotted blood adherent to it.

Ovaries.—Both are somewhat enlarged. On section the left is moderately firm in consistency and greyish white in color. The right on section contains several small cysts.

Fallopian Tubes.—Normal. Aorta—normal.

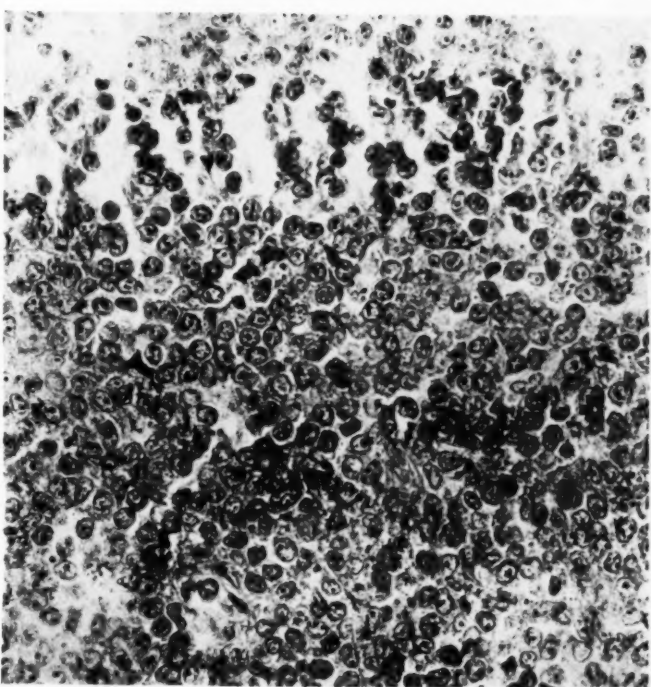
Organs of Neck.—Tongue—normal. Oesophagus—normal. Trachea—contains a small amount of bloody frothy material. Larynx—negative. The posterior and anterior axillary glands on both sides are enlarged. The largest measures 4 x 2 x 1 cm., being situated near the angle of the right inferior maxillary bone. They are discreet, gradually becoming smaller in the lower part of the neck, the supraclavicular glands being about normal in size. On section they are softer in consistence than normal

FIG. 2.



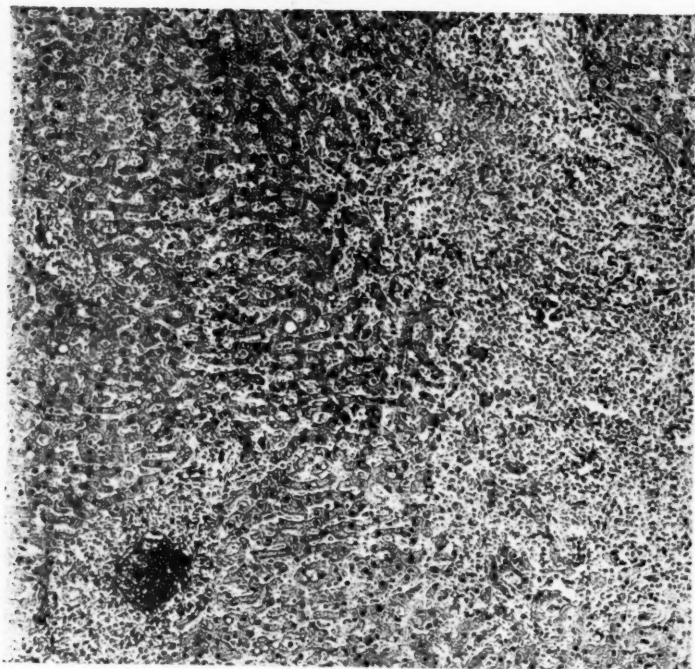
Low-power field through gingival tissue.

FIG. 3.



Low-power field (435 diameters) through gingival tissue, to show cellular character and scant stroma.

FIG. 3.



Low-power field of liver showing leukemic infiltration.

FIG. 4.



Cells (1500 diameters) showing cell structure and mitotic figure.

and the larger ones are a diffuse apple-green color. The axillary and superior mediastinal glands are apparently normal on section. The anterior portion of the superior maxillary bone is removed with following teeth *in situ*: middle incisors, lateral incisors, both canine, and the first bicuspid on the left side.

The portion of the alveolar process removed extends 2 cm. beyond the right canine and 1 cm. to left of bicuspid and shows cavities corresponding to teeth removed. The gums surrounding this have been removed and the bone is covered by blood clot. On removing this clot, a greenish grey, moderately firm mass of tissue is seen invading the alveolar process and extending upward into the antrum of Highmore on both sides. This tissue also extends along the inner margin of the alveolar process behind the teeth and onto the hard palate. The appearance of the inferior maxillary bone generally resembles the superior. The tonsils are both enlarged and on section are the same pale greenish grey color.

Bone Marrow.—Bodies of dorsal vertebræ show a reddish grey marrow. There is no evidence of chloromatous infiltration.

Anatomical Diagnoses.—Primary chloroma of superior maxillary bone; secondary chloroma of gums, palate, tonsils and cervical, posterior mediastinal, retroperitoneal and lumbar lymph nodes; cystic ovary; enlarged liver.

Bacteriological Findings.—Ærobic cultures made from the heart's blood were sterile.

Histological Findings.—Tissues were preserved in formalin, and in Zenker's fluid for histological findings.

Gingival Tissues.—Sections (Figs. 2, 3 and 4) through this show numerous large round cells infiltrating the mucous membrane, submucous and periosteal tissues. In the dense connective tissue of the periosteum the cells are often arranged in rows lying between and parallel to its fibres. In the submucous tissue they occur in solid masses, there being little supporting stroma. In some places the epidermis is absent and there are superficial ulcerations. In other places the epidermis is invaded by small groups of these cells (Fig. 2).

The invading cells (Fig. 3) are fairly uniform in size and mostly of the large mononuclear non-granular type. Stained by eosin and methylene blue, their nuclei are slightly larger than a red blood-cell. They are oval or round in shape, rich in chromatin granules, which are mostly situated in their periphery and they have a distinct nucleolus. They are surrounded by a small amount of cytoplasm which stains more faintly with the blue than the nuclei. The cell outline is indistinct. Mitoses (Fig. 5) are quite frequent, being more numerous in some fields than others. There is also evidence of amitoses, but the former are most frequent. The small rim of cytoplasm surrounding the nucleus is generally free from granules, but in a few, eosinophilic granules are sometimes present. There is an occasional larger cell with eccentric nucleus which contains eosinophilic granules that are irregular in size and shape. The cytoplasm of the latter cells is often vacuolated and they vary in size, being two to three times as large as the large mononuclear type. Sections of

tissue fixed in formalin and examined unstained show an occasional cell which contains highly refractive shining granules. In other areas there is a distinct pale greenish color to the cells in which no granules are present. None of the granules above mentioned stain by Scharlach red, and in none of the sections fixed in Zenker's fluid is there any evidence of deposition of pigment.

Superior Maxillary Bone.—Sections through the alveolar process, antrum of Highmore, and bicuspid teeth were decalcified in 5 per cent. nitric acid. The teeth are apparently normal and there is no invasion of the periodontal membrane. The alveolar process and antrum are invaded by large numbers of cells similar in morphology to those invading the gums, and in sections to which the gingival tissues is adherent they are directly continuous with one another. The bone-marrow of the superior maxillary bone is so replaced by cells of the large lymphocyte type that practically no normal marrow is present in the sections examined. There are, however, areas where a few eosinophiles and neutrophils are present, but their morphology is similar to those above. In sections where the teeth are *in situ* there is infiltration of their sockets and the surrounding cancellous bone, which is considerably rarefied.

Lymph Glands.—In the greenish colored cervical glands where the green is darker than in gingival tissue, the invasion by cells of the large lymphocyte type is so marked that the normal structure of the gland is destroyed. The study of these cells shows them to be of the same type as described above, an occasional one having eosinophilic granules. There are, however, larger numbers of cells with vacuoles, eccentric nuclei and eosinophilic granules which are irregular in size and shape. These latter cells are similar to those noted above in the gingival tissue, and the study of unstained sections shows that areas in which these are most numerous correspond with the areas in which most of the green pigment is present. The mediastinal, retroperitoneal and lumbar glands show varying degrees of invasion by the large lymphocyte type of cell. In the majority of glands there is no evidence of invasion of the capsule. In a few of the larger, however, there is an infiltration of the capsule.

Heart.—Negative.

Lung.—There is marked congestion of blood-vessels throughout. A few alveoli are filled with red blood corpuscles. There is a slight increase in the large mononuclear lymphocytes within the vessels.

Spleen.—It is slightly congested. The large mononuclear lymphocytes are moderately increased throughout, an occasional mitosis being present in them. The eosinophiles are increased to two or three times their number. The blood within the vessels shows an increase in the large mononuclear lymphocytes.

Liver.—There are small foci of leukæmic infiltration (Fig. 5) closely related to the blood-vessels, whose walls sometimes contain a few similar cells. The sinusoids also contain fairly large numbers of these cells. The infiltration varies in degree in different parts of the organ. The cells in type generally resemble those in the glands and gingival

tissue. A few are multinucleated and there is an occasional cell with eosinophilic granules which is larger than the large mononuclear type and which shows degenerative changes. There is evidence of division of these cells both within the capillaries and in the leukæmic foci. An occasional liver cell is vacuolated.

Adrenal.—Negative.

Blood-Vessels.—There is a slight increase of white cells in the blood within the vessels throughout. About 50 per cent. of these are of the large mononuclear nongranular type. Only an occasional cell has eosinophilic granules. *Aorta.*—Negative.

Tonsils.—They also show infiltration with cells of the large mononuclear type, varying in degree in different parts. In some of the crypts there is a small amount of acute inflammatory exudate.

Summary and Conclusions.—From the above findings it is apparent that this is a case of chloroma. The study of sections of the superior maxillary bone would indicate that the primary condition must be regarded as a tumor originating in this. The secondary infiltration of the periosteum, gingival tissue, lymph glands, liver, kidneys, etc., is proof of its neoplastic nature. The infiltration of the liver and kidneys is similar to that seen in the acute lymphatic leukæmias of the large cell type. The proliferation of cells takes place by both mitosis and amitosis. There is evidence of a leukæmic condition of the blood. From the fact that in this case most of the cells are well differentiated into the large mononuclear nongranular type, and that only a few contain eosinophilic granules, it does not seem possible, as Warthin suggests, that these granules account for the greenish color of the tumor. The occurrence of foci of degenerating cells in the chloromatous tissue whose chromatin shows marked chromatolysis may account for this greenish pigment.

The microphotographs were made by Mr. L. S. Brown, at the Massachusetts General Hospital, for whose careful work I wish to express my thanks.

LITERATURE.

In 1904, Dock of Ann Arbor gave a résumé of the cases of chloroma which had been published up to that date. Since 1893 there had been 21 cases, and prior to that 17 cases, making in all 38 cases. On examining the literature of the subject I have been able to find 16 cases which have been reported since 1904, bringing the total number of cases reported up to the present time to 54. The average age is 17.5 years. The average duration is 6 months. Sex: 38 males and 14 females. In 2 cases the sex was not specified.

Location of Chloromatous Growths.—The growths were situated in some part of the head in all but 4 cases, in which

the examination was complete. The most frequent seats in the head were the orbits—23 cases usually involving the periosteum; the dura or sinuses—26 cases; the temporal bone, especially in the auditory region—13 cases; the temporal fossa—12 cases; less frequently the sphenoid—4 cases; ethmoid—4 cases; the choroid plexus—2 cases; the nose, nasopharynx, maxillary antrum, pterygoid fossa, soft palate, gums and mastoid. The vertebræ were affected in 14 cases, usually in the periosteum of the bodies. The ribs were involved in 13 cases. Green infiltrations or tumors were found in the periosteum of the sacrum, coccyx, iliac bones and the bones of the extremities, in the diploe of the skull and in various flat and short bones. Chloroma was found in bone-marrow in 13 cases. The liver was the seat of green growths in 15 cases, the kidneys in 16, the spleen in 8 cases. The lymph glands were frequently involved, but the cervical glands were most often involved—15 cases. The bone-marrow of the long bones was the seat of chloroma in 10 cases, in several of which the flat and short bones were involved.

Of the associated changes it is not necessary to mention any except tuberculosis. This was found in the lymph glands in the cases of Schmidt, Rosenblath, and Koerner.

As regards the clinical features, early weakness was noted in 14 cases, pallor or anæmia in 21, exophthalmos in 15, deafness in 13, swelling of the temporal region in 15, enlarged lymph glands in 16, emaciation in 12, rapid pulse in 7. Pain was often a prominent symptom and was most often felt in the head, eyes, teeth or ears, or in the hips or legs. Hemorrhages in the skin or mucous membranes were noted in 16 cases. Blindness occurred 6 times. The liver was enlarged in 5, the spleen in 10 cases. In Lang's case, a man, aged 52 years, was seized with violent pain in the head and teeth three months before admission. In Bramwell's case the most remarkable feature was an eruption, beginning in the chest and spreading all over the body, consisting of flattened elevations, often confluent. They were superficial and painless. The

gums were enormously swollen, firm, and dark purple. The eruption on the skin in time became yellow, yellowish green or distinctly green. A similar eruption occurred in one of the cases reported by Treadgold.

The cases of chloroma with tumors of the orbit have close clinical relations with other orbital tumors and often result in sending the patient to an ophthalmologist. But the orbital tumors do not suffice to make the diagnosis of chloroma, as in addition to leukæmia without chloroma, lymphoma, lymphosarcoma and other formations often affect the orbits, causing exophthalmos in some cases. There may be no involvement of the skull.

Out of the protean symptoms of chloroma cases Dock distinguishes three sets of conditions: (1) The mechanical results of the green growths, causing many symptoms, both objective and subjective, as for instance exophthalmos, visible tumors, pain, deafness, etc. (2) The toxic symptoms, such as weakness, fever, and emaciation. (3) The blood symptoms, such as pallor, hemorrhages, and alterations of the blood itself.

The Condition of the Blood.—There is a resemblance between many of the symptoms of chloroma and those of leukæmia, especially of acute leukæmia. Ever since Recklinghausen assigned chloroma to the leukæmia group of diseases the blood has been the most important single clinical feature, but owing to the imperfect application of blood examinations in general, and to the failure of appreciating the nature of cases during life, the blood has not yet received so much attention in chloroma as it deserves. The blood in Rosenblath's first case showed: red blood corpuscles 1,000,000; leucocytes 300,000. "The small mononuclear lymphocytes appear in small numbers, and the polymorphonuclear neutrophils are scanty in proportion to mononuclear forms of various sizes, the smallest of which only slightly exceed the red corpuscles; the largest reach a considerable size. The protoplasm is usually reduced to a narrow ring, the outer layer of which often stains deeply with methylene blue. The nucleus stains rather faintly, shows usually a granular or fila-

mentous network, is round or oval, usually simple, but sometimes double. There is moderate poikilocytosis, only an occasional nucleated red corpuscle."

In Dock's case, while the blood showed some differences as compared with many cases of acute leukæmia hitherto reported, it has probably many counterparts in the latter disease. In its eosinophile cells and myelocytes it differs from Dock's 1893 case, and forms a transition from many of the other cases to that of Dunlop. In Dunlop's case the blood at first showed hæmoglobin, 32 per cent.; red blood corpuscles, 1,800,000; leucocytes, 24,500. The differential count was: lymphocytes, large predominating, 73 per cent.; polymorphonuclear, 17 per cent.; myelocytes, 5 per cent.; unclassified and transitional forms resembling myelocytes, 5 per cent.; a few nucleated red cells. The red cells fell in six weeks to 615,000; hæmoglobin, 12 per cent.; the leucocytes rose in the same time to 123,000. In Rosenblath's first case there were 300,000 leucocytes at the first examination three and a half months after the onset of symptoms. In the second case of the same author the blood was first examined eleven days after the first symptoms, and contained 40,000 leucocytes per cm., increasing in eight days to 58,000; but in two months the number was lower—37,000. The patient died ten days later. In Weinberger's case the leucocytes rose from 20,000 to 72,000 in two days. In Dunlop's case they increased from 24,500 to 123,000 in six weeks. In this case petechiæ occurred early, suggesting an alteration of the blood.

Dock says that from the data now available the relationship of chloroma to leukæmia seems settled. That the full picture of leukæmia does not always develop in all cases is to be expected. But assigning chloroma to leukæmia of course leaves unsettled many problems. One of the first questions that arises in this connection is with reference to lymphocytosis in so-called lymphosarcoma and other diseases not yet positively identified with leukæmia, but with many indications of relationship. This can only be determined by the discovery of the etiological factor.

Two other questions raised by chloroma are the nature of the color and the histologic position of the new growth.

The Color of Chloroma.—No satisfactory explanation has yet been made as to the cause of the green color. Bramwell says, "that the green discolorations, though they had hitherto been considered to be essential and characteristic features of the disease might in some undoubted cases of chloroma be absent." This shows the danger of making such a feature as color the basis of classification, especially when pertinent cases are few and the color itself is so difficult to analyze, as in chloroma. It is true that in order to deserve the term chloroma there should be a green color, but if the green color is associated with a definite structure it might be possible to make the diagnosis even if the color were absent, either naturally or as the result of preserving methods.

Treadgold thinks it very improbable that the green color is derived from ordinary blood pigment, though there is a greenish decomposition product of hæmoglobin which is never seen except in cutaneous bruises. In cases of acute leukæmia a yellowish brown pigment can be demonstrated, especially in the liver. This seldom gives the free iron reaction with potassium ferrocyanide, but is obviously derived from extravasated blood. In chloroma there usually seems to be more of this pigment, owing to the longer course of the disease and its more focal origin. The red blood cells are not so rapidly destroyed, and there is therefore more iron-containing pigment in the tissues. Abnormal myelocytes and myeloblasts are the pathogenic cells in chloroma. The green lesions are possibly due to degeneration of the granular or pre-granular protoplasm of these cells or an abortive attempt to form granulations, aided by the broken-down products of hæmoglobin. This theory is supported by the fact that no case of small round-celled chloroma has ever been reported.

VIEWS OF AUTHORS ON THE CLASSIFICATION OF CHLOROMA.

Most authors agree upon the main histologic details of chloroma. Lubarsch thought the tumors so much like lym-

phoma and lymphosarcoma histologically, that but for their green color the possibility of anything but lymphoma could never have been entertained. But he would separate chloroma, as well as lymphosarcoma and tumors of that kind which seem to have a toxic or infectious origin, from sarcoma and other autogenous tumors. "The former are merely a manifestation of a general diseased condition of the organism. Though they may develop in large numbers in the body each tumor must be looked upon as a primary condition and not as a metastatic formation depending on the dissemination of some primary autogenous growth; while they usually have a predilection for lymphoid tissue, they have been found in other parts of the body." Lubarsch, like most recent authors, agrees that Dock was right in emphasizing the differences between ordinary periosteal sarcoma and chloroma.

Rosenblath emphasized the difficulty of classifying chloroma among lymphomata on account of the tendency of the latter to remain within the capsule of the gland and not form metastases. "In chloroma, even the tumors of the orbit, which seem at first glance to act like lymphomata, are quite different. They have no capsule, and grow through fat, nerves, and muscles. The majority of the other larger tumors are closely united with the periosteum and grow diffusely."

Guembel, while he admits the resemblance of the tumor to sarcoma, points out that chloroma is essentially limited by mechanical conditions as regards its spread, unlike the unlimited growth of sarcoma. Another point is the impossibility of finding a primary growth. Other points of difference are: the absence of giant cells, of bone formation, of characteristic circumscribed metastases in internal organs. He too thinks that the cells of the tumor are of the same kind as the majority of those in the blood, the bone-marrow, and the splenic pulp.

While there are some contradictions and differences of opinion regarding the growths among those who have examined cases of chloroma, Dock thinks it can be said that histologically most of them have a structure that can best be compared with that of the leukæmic lymphomata. That certain

variations occur, however, seems beyond question, and Dock believes that Dr. Warthin's examinations in this case reveal some important demonstrations of this fact.

Weinberger believes that in chloroma we are dealing with an acute myeloid proliferation. This is indicated by the large number of polymorphonuclear leucocytes which are present in the blood, the majority of these cells being neutrophile granular, while a few exhibit scanty granulations or none at all. A further proof is that most of the mononuclear cells show fine or coarse neutrophile granulation, and the nongranular cells are usually furnished with a basophile protoplasm, which is not as a rule found in lymphocytes. The presence of normoblasts and eosinophiles is also in favor of myeloid proliferation. He considers that it is not justifiable to regard this anatomically and clinically distinct disease as merely a symptom, and that at the same time leukæmia is not identical with sarcomatosis of the lymphoid and myeloid apparatus respectively. He considers it to be a combination form of leukæmia with lymphosarcomatous proliferation, and suggests that chloroma should be included in general lymphoid and myeloid conditions respectively.

In the case reported by Pope and Reynolds the clinical course, the history and the distribution of the lesions suggested an infective process, and by means of a special method of fixation and staining they were able to demonstrate in the green material a bacillus resembling the bacillus Mallei. The distribution of the bacillus was precisely that of the pigment, and it was especially numerous in the endothelioid and pigment cells.

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CERVICAL SUBCUTANEOUS CAVERNOUS HÆMANGEIOMA.

WITH REPORT OF TWO CASES.

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INTERMUSCULAR cavernous hæmangioma of the neck is sufficiently uncommon and interesting to warrant placing the following two cases on record.

CASE I.—A young woman, twenty years of age, first came under observation in August, 1907. Except for the ordinary diseases of childhood she had never been ill. Immediately following convalescence from an attack of mumps when the patient was eight years of age, a small soft swelling was first noted on the right side of the neck. The swelling gradually increased in size. Since 1905 it has been intermittently larger and smaller. The variations in size were apparently causeless and did not bear any relation to the menstrual periods. When small the swelling was symptomless except for the deformity, when large it produced moderately severe shooting pains in its immediate vicinity.

On examination the patient presented a tumor the size of a small hen's egg in front of the right sternomastoid muscle, just beneath the angle of the jaw. The overlying skin projected a little above the surrounding area, but was non-adherent and was normal in color. On palpation the swelling imparted the sensation of an accumulation of fluid under slight tension. During direct pressure by the fingers the tumor projected less prominently, but at the time of the examination this was supposed to be due to its being flattened. Except for its long duration the tumor corresponded to a deep-seated cold abscess. The possibility of hæmangioma was not considered. A diagnosis of cyst probably of congenital origin, but possibly originating in the parotid gland

* Read before the Philadelphia Academy of Surgery, November, 1909.

secondary to the attack of mumps, was made before operation. At four examinations covering a period of two months no appreciable change in the size of the tumefaction was noted.

The patient was operated upon at the University of Pennsylvania Hospital, October 30, 1907. A transverse incision through the skin and platysma exposed the tumor which presented an appearance similar to a vascular goitre. The dissection of the tumor from the surrounding tissues did not present any difficulties. Bleeding was free from one point where the tumor was nicked with the knife, but was easily controlled. The bleeding caused collapse of the tumor and facilitated its removal which was accomplished after clamping hæmostats on two small veins above and one below the tumor. On cross section the tumor resembled the erectile tissue of the corpora cavernosa. The platysma and skin were sutured in separate layers. The wound healed by first intention.

CASE II.—The second patient was a man twenty-eight years of age who had recently come to this country from Turkey. He had had a swelling of the neck from early childhood. The tumor increased slowly but steadily in size. At the age of fifteen years an exploratory incision was made under local anæsthesia but the removal of the tumor was not attempted. An immigration commissioner brought the patient to the Philadelphia Hospital to ascertain if the tumor constituted a legal barrier to his remaining in the United States. The patient was admitted on the service of Dr. Edward Martin through whose kindness I was permitted to operate.

The examination disclosed a rounded slightly elevated non-pulsating tumor of indefinite outline situated on the left side of the neck. It extended from the median line to the sternomastoid muscle and from just beneath the inferior maxilla to a line two inches above the clavicle. About the middle of the tumor was an unsightly ovoid scar resulting from the exploratory incision. The overlying skin did not present any abnormalities in color and was not adherent to the deeper tissues except at the scar. On palpation it simulated a fibrolipoma, being composed chiefly of soft tissue in which could be felt irregular fine bands and small nodules of firmer tissue. The tumor could be diminished in bulk by pressure but promptly regained its original size on relief of pressure. The most striking symptom was an enormous

FIG. 1.



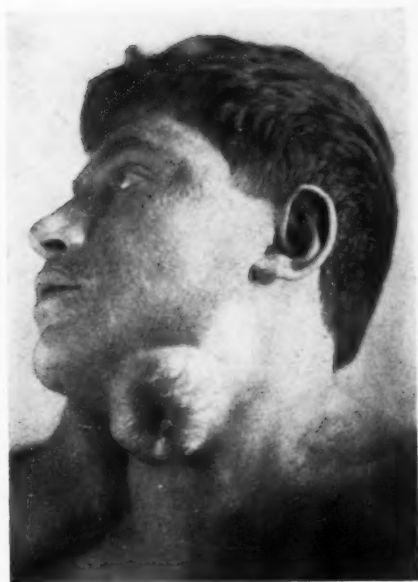
FIG. 2.



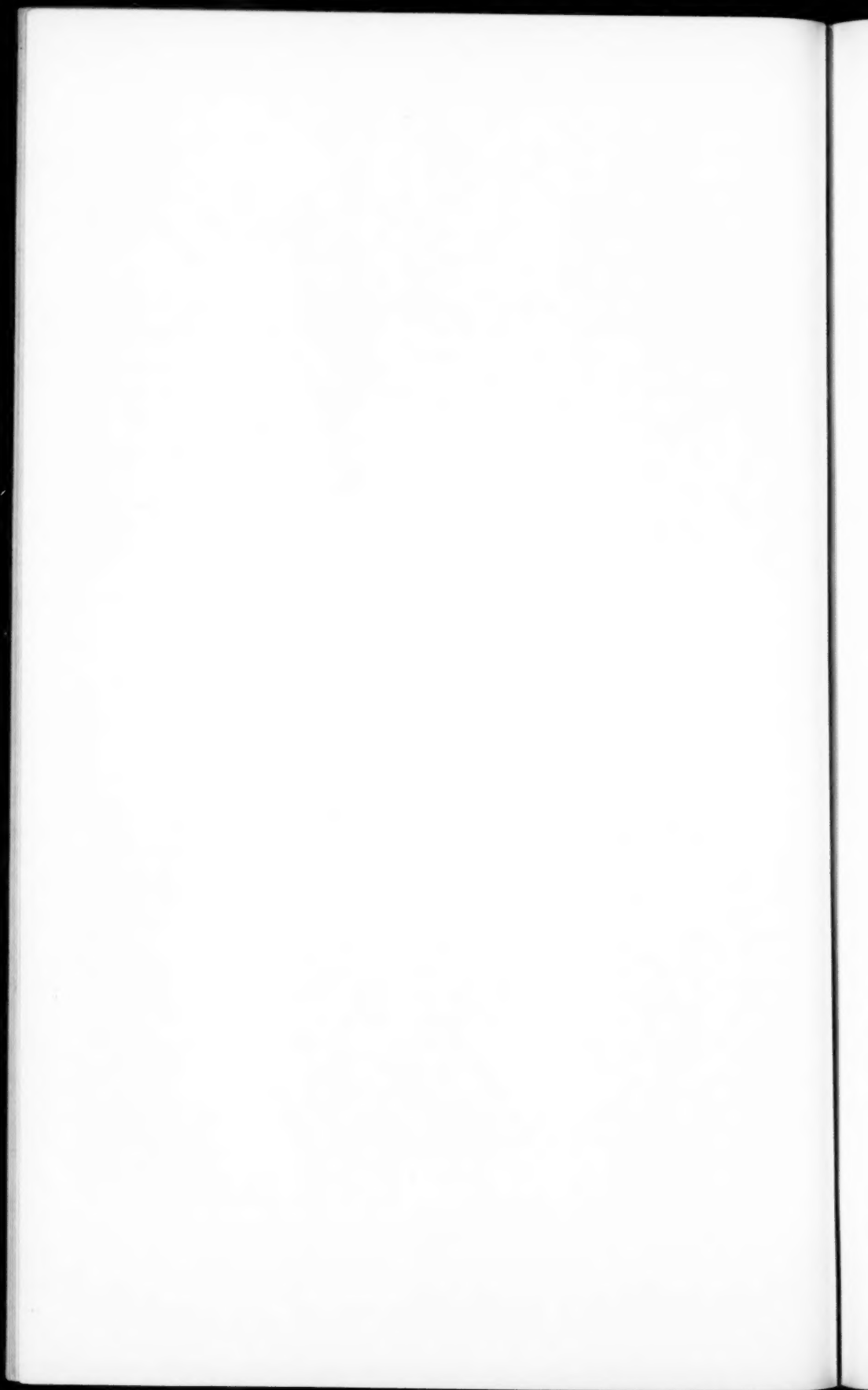
FIG. 3.



FIG. 4.



Figures 1 and 3 represent the tumor in passive state, and figures 2 and 4 the distended tumor.



increase in size produced after deep inspiration by forced expiratory efforts with the glottis or the mouth and nose closed. This is well illustrated by comparison of Figs. 1 and 3 with Figs. 2 and 4. The tumor would increase in size during the entire period of a single expiratory effort prolonged to the point of fatigue, but would not gain its maximum size until the patient had quickly taken a second inspiration and repeated the straining effort at expiration. In the short interval between the two expiratory efforts the tumor decreased but little in size. On cessation of straining the tumor shortly returned to its original outlines. Deep inspirations or direct pressure hastened the subsidence of the swelling. Pressure over the course of the internal jugular vein at the base of the neck caused a slight enlargement. Percussion over the tumor in its passive state yielded a tympanitic note practically identical with the corresponding area on the opposite side of the neck. When the tumor was fully distended the percussion note over it was still tympanitic but somewhat higher pitched than on the opposite side. Auscultation over the tumor during quiescence and during alterations in its size failed to elicit any adventitious sounds. The tumor did not give rise to any pressure symptoms. Examination of the mouth, pharynx and larynx failed to reveal anything abnormal. Examination of the pharynx while the tumor was fully distended was not made, but, as shown by the findings at operation, it probably would have revealed a bulging of the lateral pharyngeal wall. A diagnosis of hæmangeioma was made prior to operation.

In March, 1908, a transverse elliptical skin incision so placed as to remove part of the old scar was made across the central part of the tumor. The platysma over its area of attachment to the tumor beneath the scar was not disturbed but elsewhere was dissected back with the skin flap. The angiomatous tumor thus disclosed was approached at its lower border and gradually enucleated from below upward. The anterior projection of the tumor lay in direct contact with the wall of the pharynx between the superior and middle constrictor muscles. After removal of the tumor from this region the pharyngeal mucosa flapped in and out with each respiration. The posterior portion of the tumor was situated beneath the sternomastoid muscle in close contact with but not adherent to the internal jugular vein and carotid artery. Seven veins about the size of the median basilic

vein entered the tumor at various points along an arc extending from immediately below the hyoid bone to the angle of the jaw. A large venous trunk about three-fourths of an inch in length connected the deep surface of the tumor with the internal jugular vein on a level with the hyoid bone. Except for a few very fine arterioles there were no arteries entering the tumor. There was no true encapsulation of the tumor but the line of cleavage between it and the surrounding tissues was distinct and easily followed during the dissection. The operation was not difficult and was practically bloodless, but was somewhat tedious owing to the uncertainty of the conditions to be encountered. After excision of the tumor, the middle and superior constrictors were approximated with a few sutures to support the wall of the pharynx, and the platysma and skin were united in separate layers. The patient made an uneventful recovery.

Microscopical examination of the excised tumor revealed typical cavernous angioma with an admixture of fibrous and fatty tissue in both cases.

Cavernous hæmangioma is a vascular tumor having a structure similar to that of the corpora cavernosa. The intercommunicating blood spaces are punctiform to a pea size or larger and are lined with endothelium. The supporting connective tissue network in some instances may contain a small amount of smooth muscle fibres and elastic tissue. The blood spaces of the tumor have no connection with the capillaries of the surrounding tissues (Ribbert). The blood which circulates through the tumor is supplied usually by the venous system, rarely by the arterial. Cavernous hæmangioma may involve the skin, subcutaneous tissues, intermuscular tissues, muscles, bones and viscera. It occurs more commonly in the female sex. An hereditary tendency has been observed but not with sufficient frequency to be worthy of any great consideration. Trauma has been ascribed as a predisposing factor but it probably has served to direct attention to the lesion rather than to cause it.

Pathologists are by no means agreed as to the mode of origin of cavernous hæmangioma. Some regard it as a

primary neoplasm and others advance numerous theories to account for its development secondary to changes in the vascular and lymphatic systems and the connective tissue. Cavernous hæmangioma may be single or multiple. If multiple the individual lesions may be adjacent to one another or may occupy widely remote regions. Subcutaneous and cutaneous hæmangiomata occasionally coexist either in the same region or in widely separated areas. A cavernous hæmangioma may arise primarily as such or it may develop secondarily by transformation of a simple hæmangioma.

Subcutaneous cavernous hæmangioma has frequently been observed at birth, thus proving that it may be congenital. More commonly, however, it first comes under observation during childhood and occasionally later in life. Even these cases may be and probably are congenital in origin but escape attention owing to their deep situation and early latency or slow growth. As a rule, the first symptom to attract attention is the presence of a swelling which projects above the surface. The overlying skin is normal in appearance and is not adherent. A bluish tint is sometimes apparent through the semitranslucent skin of young children, particularly when the tumor is distended. Neuralgic pain from nerve pressure is sometimes present but is an inconstant symptom. The tumor is characterized by transient variations in its size depending upon the amount of blood contained in the cavernous tissue. Factors causing an increase in the general or local venous blood pressure as crying, coughing, straining, dependant position of the affected region and pressure on the efferent vessels produce an enlargement of the tumor which subsides as soon as the venous tension returns to normal. The size of the tumor can be diminished temporarily by direct pressure, by elevation of the part or by compression of the afferent vessels. The extent to which the tumor can be made to disappear by manual pressure depends upon the number and size of the blood spaces, the thickness of their intervening walls and the amount of connective tissue stroma. When fully distended the subcutaneous tumor imparts to the pal-

pating fingers the sensation of a tense cyst. Depending upon the relative proportion of vascular spaces and connective tissue stroma the flaccid tumor on palpation may simulate a cold abscess, a lipoma or a fibroma. Phleboliths when present are palpable as shot-like bodies. There may be a transmitted pulsation from an underlying artery and in the exceptional instances in which the hæmangioma has an open communication with an artery expansile pulsation and bruit are present. Hæmangiomata yield a flat note to percussion.

The clinical course of these tumors varies greatly in the individual cases. They may enlarge slowly or rapidly from the first or they may remain quiescent for years. Periods of rapid growth may alternate with periods of slow growth, latency or actual diminution. They rarely exceed the size of a man's fist. Continued growth may lead to coalescence of the central blood spaces and the formation of a blood cyst having a shell of cavernous tissue at its periphery. As the result of traumatism or infection a cavernous hæmangioma may become swollen, hard, tender, and irreducible. The inflammatory process may subside completely without having caused any demonstrable alterations in the angioma. Thrombi, however, may form in the blood spaces and in the blood-vessels connected with the tumor, and their subsequent organization will lead to a partial or complete cure. Some of the thrombi may become calcified and persist as phleboliths. Even in the absence of inflammation a hæmangioma may undergo retrogressive changes and spontaneous disappearance. A cavernous hæmangioma not infrequently may participate in the formation of a mixed tumor, particularly with a lipoma or fibroma. Rarely a hæmangioma may be the starting point of a sarcoma or an endothelioma. Cavernous hæmangioma of the neck may originate in the skin, subcutaneous tissues or intermuscular tissues. Intramuscular hæmangioma has never been reported in the cervical region. The deep seated hæmangiomata tend to extend toward the surface and the superficial to extend deeply so that long standing large tumors are prone to involve all three planes of tissue.

Those which begin superficially, however, commonly show a much greater extent of cutaneous involvement than those which originate in the deeper tissues. Strictly speaking, the two cases here reported, being situated beneath the platysma, belong to the intermuscular variety, but in the further description of these cases no attempt will be made to differentiate the intermuscular from the subcutaneous forms.

The subcutaneous cervical hæmangeiomata when large may give rise to dysphagia, dyspnoea and dysphonia. An angioma is affected by respiratory straining in the cervical region to a greater degree than in any other part of the body. A hæmangioma located anterior to the sternomastoid muscle lies in such intimate relation with the trachea, larynx or pharynx that the percussion note over it is resonant or tympanitic. A higher pitched note is obtained, however, (1) by percussion over the tumor than over a corresponding point on the opposite side; (2) by superficial than by deep percussion and (3) by percussion over the fully distended tumor than over the compressed tumor. The lesions most apt to be confounded with a cervical subcutaneous cavernous hæmangioma are aërocele, lymphangioma, aneurism, cysts, hernia of the lung, cold abscess, fibroma and lipoma.

A hæmangioma at the front of the neck may resemble an aërocele, in being resonant or tympanitic, compressible and distensible; in causing disturbances of speech and respiration and in having its volume influenced by respiratory straining. In my second case it was only after repeated examinations that aërocele was definitely excluded. An aërocele, however, is somewhat more frequent in males and it occurs with about equal frequency at all ages, whereas hæmangioma is more common in the young of the female sex. Aërocele may give a preceding history of violent straining as during childbirth, prolonged coughing, traumatism, intralaryngeal or intratracheal ulceration or cervical abscess rupturing into the air passages. An aërocele has a direct connection with the trachea (tracheocele) or larynx (laryngocele) from which it cannot be displaced, whereas the angioma

may not present any such intimate relation. Examination of the interior of the larynx and trachea may reveal an opening communicating with the tumor in *aërocele* or possibly a bluish discoloration of the mucous membrane in *angioma*. The *aërocele* is more completely reducible than the *angioma* and its distention can be prevented by pressure over the point of its communication with the air passages. The size of the *angioma* is influenced by pressure over the vessels. As a rule, respiratory efforts produce a more prompt change in the volume of the tumor in *aërocele* than in *angioma*.

A lower pitched resonant or tympanitic note is obtained by percussion over an *aërocele* than over the surrounding area or over the corresponding region on the opposite side of the neck. The percussion note is likewise lower pitched when the *aërocele* is distended than when it is collapsed. The reverse is true with an *angioma*.

Auscultation demonstrates adventitious sounds coincident with respiration in the *aërocele* and is negative in *angioma* except in the rare cases where the tumor has an open communication with an artery and then a bruit will be heard coincident with the pulse. A skiagraph may reveal the presence of phleboliths in an *angioma*. An exploratory puncture with a hollow needle will obtain blood from the *angioma* and a gush of air from the *aërocele*. The escape of air usually is sufficiently forcible to be manifest, but may be demonstrated by attaching to the needle a rubber tube one end of which is held beneath the surface of a liquid. *Aërocele* does not enter into the question of differential diagnosis in the case of an *angioma* situated posterior to the sternomastoid muscles.

Cavernous lymphangioma may present symptoms identical with cavernous hæmangioma with the exception that the exploring needle will withdraw a serous or milky fluid in place of blood. Cavernous lymphangioma, however, usually occupies a superficial position in the neck and is adherent to the skin, in which case the absence of skin discoloration points to the diagnosis of lymphangioma as against hæmangioma.

Aneurisms of the neck usually assume an elongated form in the course of the larger vessels and are found in patients beyond middle age. Hæmangeiomata usually assume a globular or flattened outline and are found in the young. In traumatic aneurisms the history points to the diagnosis.

Hæmangeioma can be diagnosed from the majority of cysts and solid tumors of the neck by the alterations in its volume during compression and distention. The diagnosis from air cysts having an open communication with the respiratory passages has been discussed under the term *aëroceles*. In cases of cysts and diverticula communicating with the pharynx or œsophagus diminution in size from direct pressure is associated with a regurgitation of mucus or food.

Vascular goitre may simulate hæmangeioma by its variations in size incident to alterations in the local blood pressure, but the position and outline of the growth and the associated solid enlargement of the thyroid serve to exclude it. Intermittent enlargement of a salivary gland from incomplete obstruction of its duct might suggest hæmangeioma, but its situation, the swelling coming on during or immediately after meals, often accompanied by salivary colic, the diminution on direct pressure causing a flow of saliva from the affected duct, and the associated signs of a stone or stricture in the duct, serve to differentiate this condition.

The differential diagnosis of hæmangeioma from blood cysts which have preserved their communication with the blood-vessels is impossible. The more nearly complete the disappearance of the tumor by direct pressure the greater is the probability of its being a blood cyst. The presence of other angiomatous tumors favors the diagnosis of cavernous angioma as opposed to blood cyst.

Hernia of the lung is always found at the base of the neck, is usually completely reducible, can be prevented from recurring by pressure over the opening through which it escapes, yields crepitation on palpation and breath sounds on auscultation. Hæmangeioma is more common in the upper cervical region, is incompletely reducible, may be affected in

size by pressure over the blood-vessels connected with it, usually presents the signs of an admixture of fatty and fibrous tissue, may contain phleboliths and is negative to auscultation, except in rare instances when bruit may be obtained.

Subcutaneous cavernous hæmangioma is such a comparatively rare tumor that the possibility of its occurrence was not considered in most if not all the reported cases erroneously diagnosed as cold abscess, lipoma, fibroma or fibrolipoma. In none of these cases was the erectility and compressibility of the tumor noted. Had tests been employed to determine the presence of these symptoms a faulty diagnosis might have been avoided. It is also probable in these cases that the clinical picture was not in perfect accord with the condition diagnosed. In my first case, for instance, the local findings simulated cold abscess, but the history of its beginning as a soft painless swelling and the duration of twelve years excluded that diagnosis. In the second case the collapsed tumor resembled a fibrolipoma on palpation but was atypical of the latter neoplasm by reason of its flaccidity. The difficulties of diagnosis are illustrated by Fisher's case of angiofibroma involving the tongue, floor of the mouth and upper part of the neck. Fisher recognized the fact that he was dealing with an unusual tumor and made repeated punctures from the skin surface with a hollow needle. Blood was obtained but once. The point of the needle apparently was buried in the fibrous tissue in the remaining trials.

The clinical history of a hæmangioma resembles that of a cold abscess in those cases in which the angioma has escaped observation up to the time of its developing an inflammatory induration which may resemble a lymphadenitis, and the subsequent softening on subsidence of the inflammation may be mistaken for the breaking down of glandular tissue.

The occurrence of a fibroma or lipoma in the form of a mixed tumor tends still further to obscure the presence of the angiomatous elements.

The clinical features of a cold abscess, lipoma and fibroma are too well known to require discussion. In any given case

suspected of being one of these conditions, but which in any way is atypical, the examination should be conducted with a view to determining the possible presence of the compressibility and distensibility characteristic of angioma.

A subcutaneous hæmangioma of the neck which is quiescent or undergoing spontaneous resolution may be treated expectantly but should be kept under observation. A continued increase in size calls for active interference.

Electrolysis, the injection of coagulating fluids, the introduction of magnesium darts, subcutaneous ligation and similar forms of treatment are attended by serious risk of damage to adjacent important structures, particularly if persisted in to the point of complete disappearance of the tumor. One or more of these methods might be employed in cases of very large angiomas, to reduce their size preliminary to excision, but their beneficial effect is apt to be counterbalanced by the production of adhesions.

If the claims made for radium be substantiated it will prove the most acceptable form of treatment, otherwise complete excision is indicated. Complete destruction or removal is necessary to guard against recurrence.

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ANEURISM OF THE INTERNAL CAROTID TREATED BY MATAS' METHOD.

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AND

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WE believe that the following case is worthy of reporting because, first, no similar case of aneurism of the internal carotid surgically treated has ever been reported, and, second, because the technical difficulties encountered in this case (which necessitated freeing the aneurismal sac from the surrounding structures) and the subsequent sloughing of the sac wall as a result probably of insufficient blood supply, add something to our knowledge of the factors which determine success or failure in conservative aneurismorrhaphy.

CASE.—Mrs. M. B., age 60; referred to us by Dr. Bates. One year ago she first noticed a pulsation in right side of neck, and since that time there has been a painless pulsating, gradually but steadily developing mass just above the bifurcation of the carotid on right side of neck. There has been no evidence of nerve involvement, no cerebral symptoms and the general health of the patient has remained good. The patient's previous medical history is not noteworthy and nothing can be elicited to suggest a specific infection.

Examination shows a small framed, fairly well-nourished, well-preserved woman. Beneath and behind angle of jaw on the right side is a pulsating mass apparently about 3.5 cm. in diameter. This mass is equally prominent internally in the region of the tonsil. The usual physical signs of aneurism are present. General physical examination negative.

Operation.—December 29, 1908. Ether anaesthesia with Crile nasal intubation. Vertical incision anterior to sternomastoid. Exposed common carotid and applied Crile clamp. Dissected upward anterior to internal jugular, ligating anterior venous

and occipital and ascending pharyngeal branches of external carotid. Saccular aneurism of internal carotid arising 4 cm. above bifurcation. Sac about 4 cm. in diameter. Impossible to control return blood without dissecting sac free from adherent tissues. Pull on vagus reduced heart beats from 70 to 40 per minute for a half minute or less. Placed Crile clamps on internal carotid above and below aneurism, also untied ligatures to be used in case of emergency. Opened sac longitudinally and removed some fresh blood clot. Neck of sac sharply defined arising from about 2 cm. of artery. Closed sac by four rows of through and through silk sutures (No. 12 cambric needles and No. A silk, saturated with vaseline) the first row being so placed as to close the neck of the sac with preservation of lumen practically without narrowing. Removed Crile clamps and emergency ligatures. Only slight bleeding from stitch holes—easily controlled by temporary gauze pressure. Vessel pulsating normally when last seen. Incision closed with deep plain catgut sutures; horse-hair skin sutures. No drainage. No bad effects noticed from temporary compression of internal carotid, which lasted about twenty-five minutes.

December 31, 1908.—General condition of patient good. Paralysis lower branches of facial on right side (cut during operation). Decided weakness of left arm. Slight weakness of left leg. Yesterday patient was dull and apathetic and at times slightly delirious, but mental condition is much better to-day.

The mental condition and the weakness in left leg improved rapidly but weakness in left arm persisted with apparently fairly marked variation from day to day. The post-operative history was otherwise entirely uneventful until the eighth day when the patient developed a sore throat and stiff neck, with a temperature of 102 degrees. At this time a swelling was noticed in the region of the wound and the same was opened by blunt dissection and about 30 c.c. of serosanguinous fluid evacuated. Temperature and sore throat subsided on the twelfth day and patient was discharged apparently well on the fifteenth day, her condition being apparently perfect except for a slight weakness of the left arm.

Three days after leaving the hospital a hæmatoma formed beneath the scar, which was opened and drained. The next day there was a moderate hemorrhage. On the twentieth day follow-

ing the operation a large hæmatoma formed in the neck and it was decided to reopen the wound and ligate the bleeding vessel. Under ether the incision was opened and immediately there was an alarming hemorrhage. The common carotid was at once clamped, but the hemorrhage came chiefly from above and all clamps placed on the internal carotid above the site of the aneurism simply ruptured the friable vessel wall. The hemorrhage was finally controlled by packing, but the patient died within a few hours from the effects of the hemorrhage. Examination at time of second operation showed that the flaps of the aneurism sac had apparently sloughed. The secondary hemorrhage came apparently from the junction of the upper end of the sutured aneurism sac with the internal carotid.

No autopsy was permitted.

AN OPERATION FOR PARALYTIC SHOULDER JOINT DUE TO INFANTILE PARALYSIS.*

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I wish to report to this society a case of paralytic shoulder joint due to infantile paralysis, upon which I operated to improve a function. Its history is as follows:

The patient, a girl of sixteen, presented herself with a typical dangling shoulder joint, for examination to ascertain whether the function of the left upper extremity might be improved. She gave the following history. The past history shows nothing of importance. The present history goes back to a time nine years ago, when she began to complain of pain in her left wrist which she attributed to pulling a boat on shore. The same evening she complained of a headache which persisted until the following morning, when she had a chill and high temperature. She had no convulsions, did not vomit, nor did she complain of pain anywhere. Temperature persisted for three days, at the end of which time her mother noticed that the patient was unable to move her left arm. She was treated for a year for this by an osteopath with no result but rather a progressive atrophy of the arm and a continuing loosening of the shoulder joint. She then went to an orthopaedic surgeon who put her arm in a splint in flexion at the elbow, with the result that motion of the elbow gradually became diminished.

She comes to the hospital now on account of being unable to move her left arm in any direction, except slight inward rotation. She also complains of inability to flex the forearm. She does not complain of any sensory disturbances. Chief complaint: inability to use left arm.

* Read before the New York Surgical Society, Oct. 27, 1909.

Inspection shows a typical flail-like appearance of the left upper extremity. It hangs straight downward with a slight inward rotation. The fingers are somewhat flexed. The head of the humerus hangs down from the acromion over two and one-quarter inches. The entire extremity appears highly atrophied.

Passive motion in the shoulder joint is possible to an excess. Active impossible. Passive motion of the elbow shows that flexion and extension are perfectly free, but pronation and supination are reduced to a minimum. There is slight paradox insufficiency of the flexions of the hand owing to their shortening. There is atrophy of the interossei.

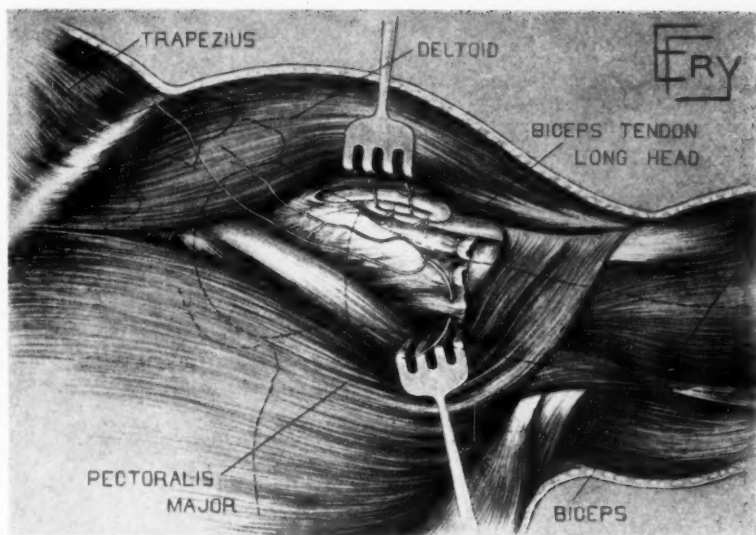
The active function of the arm is *nil* except a slight forward motion. Abduction is entirely absent. The arm cannot be moved away from the hip. Outward rotation does not exist. A slight inward rotation is possible.

The practical use of the arm is as follows: If the hand and forearm are brought backward by the other hand, the patient can tie her skirt strings. She can dress her hair by sitting low next to a high dressing table, upon which she brings her left elbow with her right hand, whereupon she can use her forearm, and then fix her rather complicated coiffure.

Besides the loss of function the cosmetic effect of the dangling shoulder with its pronounced atrophy is rather annoying to the young woman, the atrophy showing quite plainly even when the patient is dressed. Close examination of the undressed patient reveals a slight atrophy of the left lower extremity which is unknown to the patient or her mother. There are no functional disturbances in the lower extremity.

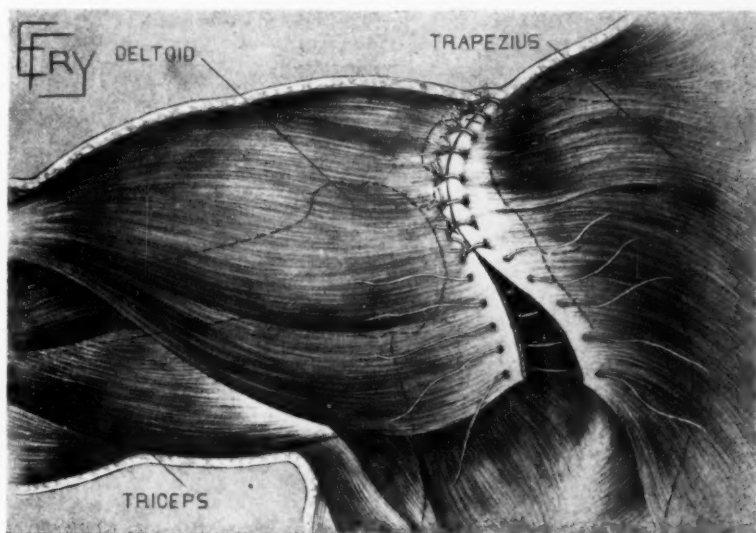
The nerve status is as follows: Cranial nerves—no disturbances. Upper extremity—right upper extremity appears normal in contour, motion, and sensation. Left upper extremity—no sensory disturbances. The left arm appears extremely thin, and flail-like. There is complete atrophy of the deltoid, biceps, triceps, brachialis anticus, coracobrachialis, supraspinati, and teres major and minor. All these muscles give a complete reaction of degeneration. The patient is unable to move her left arm in any direction except to rotate the arm inwardly to a slight degree. The left forearm shows no sen-

FIG. 1.



First stage of operation. Front view, arm elevated.

FIG. 2.



Rear view.

FIG. 3.



FIG. 4.



sory disturbances, and no motor disturbances. The patient is unable to flex the forearm voluntarily except when it is flexed to ninety degrees. She can then voluntarily flex it further. In the hand there are no sensory or motor disturbances except a diminished opponens action of the thumb. There is atrophy of the interossei. Reflexes present in forearm but not in arm.

Trunk—no sensory or motor disturbances.

Lower extremities—no sensory or motor disturbances. Reflexes active. Slight atrophy of the thigh and leg visible to the eye and shown by a slight difference in the measurements.

There is quite a lateral curvature of the spine which has developed owing to the diminished weight of the left upper extremity, and the lack of its use.

With the history of a three days' high fever, after which the left upper extremity appeared paralyzed, there could be no question that the condition described was due to infantile paralysis. It is only surprising that this diagnosis had not been made before.

To improve the function, especially to give the patient abduction, which was absolutely absent, it was a question whether arthrodesis was to be performed or some other operation.

The opinion expressed in the "Handbuch der Orthopædie," that an upper extremity whose muscles are completely paralyzed is a perfectly useless appendage, even if the muscles of the forearm are intact, is not correct. It is true that the pectoral and latissimus dorsi can only produce a certain swinging motion, but as you have seen from my description of the status, the arm could be used to quite some purpose. Therefore, I came to the conclusion that arthrodesis, even if it was a success, would diminish the usefulness of the arm. It would then have been impossible to bring the hand back to tie the skirt strings, and the passive elevation of the arm in the shoulder joint to dress the hair would also have been obliterated. I therefore concluded that I would make the following operation, consisting of three parts:

On May 19, 1909, an incision was made about nine inches in length at the anterior border of the deltoid. The capsule

was easily exposed and severed horizontally at its insertion to the humerus in about three quarters of its circumference. The biceps tendon was not cut through. The free upper border was sewed down to the periosteum of the humerus about two inches and a half lower down. This was done while the arm was brought in horizontal position. Then the long tendon of the biceps was pulled through the intertubercular mucous sheath of the capsule, and the surplus material used to make a double loop which was sewed together.

These two steps in the operation brought the head which had been hanging down more than two inches and a quarter hard up against the glenoidal fossa. Then I dissected the deltoid from the clavicle and the acromion entirely, so that the upper border was completely free. Then the insertion of the trapezius was severed from the two bones named. The free edges were then united by interrupted chromic catgut sutures, thus making one muscle out of the shoulder part of the trapezius and the deltoid.

The wound was completely closed and healed promptly by primary union. The arm was dressed in abduction. In seven days the wound was completely healed, but the abducted position was kept up for two weeks more. A prolonged fixture in this position, to avoid stretching of the tissues shortened, was not deemed advisable to avoid possible stiffness of the joint.

Three weeks after the operation the patient began to use her arm, and slowly could abduct the arm from the hip. The accompanying photograph shows how much she could abduct the arm three months after the operation. The contraction of the cucularis, which by its attachment to the deltoid lifts the arm, is seen very plainly in the photograph showing the patient from the rear.

It could not be expected that a complete elevation of the arm could be achieved, as the paralysis had existed for nine years.

Besides the new function, abduction, which may increase later on, the cosmetic effect is quite marked as the shoulder appears now round, and does not show any deformity when the patient is dressed.

The idea of implanting the deltoid into the cucularis is Hoffa's, who has done this operation as far as I find, twice.

Koelliker has shortened an unduly long stretched capsule by shirring it.

To use the tendon of the biceps to suspend the arm in its proper position has not been described in the literature available to me.

The combination of the three operations appealed to me as rather reasonable, and the patient and I are both well satisfied with the result.

THE SURGICAL TREATMENT OF EMPYEMA THORACIS.

BY CHAUNCEY E. TENNANT, M.D.,

OF DENVER, COLORADO.

WHILE the surgical possibilities in the thorax have been increased during the recent experimental period, and especially since the introduction of the Sauerbruch negative pressure cabinet,¹ the results attained in pulmonary work have not as yet proven altogether satisfactory. Although the writer firmly believes that successful pulmonary surgery will be one of the triumphs of the near future, he also believes the infections limited to the pleural space have not yet yielded to the old and well tried methods such results as we have a right to expect.

That so many of our cases of empyema thoracis should require extensive rib resections, with its prolonged disability, or that we should have the protracted sinuses, suggests the probability that we may not yet be applying the proper early treatment to our cases. We seldom meet with such difficulties in the abdominal cavity, and we should expect to secure equally favorable results in the thoracic cavity.

Murphy² has recently recommended and systematically used in all his cases of postpneumonic empyema (in which there is no pulmonary gangrene abscess or bronchial communication) a method of simple aspiration of the purulent effusion, and with the same needle still in place, introducing one or two ounces of a twenty-four-hour old two per cent. solution of formalin in glycerin. This treatment is usually repeated every two to four weeks, until the fluid becomes serosanguinolent and is later absorbed. He claims for this treatment the speedy cure of the majority of his early cases of empyema.

It would seem, however, quite improbable that by this method the entire collection of pus could be removed. Then,

too, one is not always certain that the fluid is circumscribed in the pleural space, for inaccessible patches of purulent material may be left well out of reach of the aspirating needle and its hygroscopic solution. While these last possibilities stamp this method as not altogether a good surgical procedure, the general principle of the treatment is sound, since the normal intrathoracic atmospheric pressure difference remains undisturbed.

Various suction devices have been suggested and used for many years, all with the idea of an early lung expansion, notably among these is the method of Weller Van Hook,³ which is a stationary vacuum chamber maintained by an ingenious syphon device—this chamber being attached by a long rubber tube to the drainage tube and the latter inserted into the thoracic incision made by the excision of a portion of one or more ribs. The long rubber tube connection makes it possible for the patient to move about the room with considerable freedom.

Bryant⁴ has recently advocated the attachment of a deflated elastic rubber bulb such as the Pulitzer bag, this to be attached directly to the drainage tube which is fairly well sealed in place by rubber sheeting and emptied of its contents when fully expanded. Brewer⁵ refers to the use of the glass cup connected to a collapsible rubber bulb, such as is more recently known as the Bier hyperæmia device.

In each of these methods, with the exception of the latter, the flaw in the technic is the use of the drainage tube left in the cavity for so long a time, this being one of the strong factors in the production of the persistent sinus. The same criticism may be made of the writer's air-check device, reported in the *Journal of the American Medical Association*, November 16, 1907.⁶

Recent experimental work in the thorax with the negative⁷ or positive pressure apparatus, and also without this device, successfully demonstrates the possibility of intrathoracic work, providing the lung does not collapse,—or in the event that it should, the possibility of its early restoration to a normal degree of expansion. This simple principle applied

to the treatment of purulent accumulations in the pleural cavity seems to be the secret of success in effectually shortening the convalescent period in the early cases of empyema following pneumonia. To secure this expansion with a foreign body, such as a drainage tube, inserted through a wound into the pleural cavity, seems to the writer an utter impossibility. Then too, the longer the period of delay in the recovery of these cases the greater becomes the thickening and contraction of the pulmonary pleura, and when this organized fibrous covering has formed about the lung it is too late to undertake anything short of an extensive thoracoplasty.

As has already been suggested, to secure an early successful pulmonary expansion, either of two now well-known methods may be employed; that of positive pressure by forcible introduction of air into the bronchial tubes and air cells, or, by the exhaustion of a certain amount of air from an enclosed and air-tight compartment in which the thoracic cavity is placed, with the respiratory passages exposed to the natural atmospheric pressure.

In either event, it is naturally implied that there must be a direct opening into the pleural cavity. Where there is a direct communication with a bronchus, however, pulmonary expansion by this means is not so readily obtained, although in empyema after the removal of the hydrostatic pressure of the purulent fluid within the cavity, this complication often quickly disappears.

While the radical operative methods of free rib resection sometimes used in the early history of these cases should be mentioned only to be condemned, still the early adoption of free and effective drainage of the pus cavity is more likely to secure the early reduction of the pleural hydrostatic pressure and the sequent pulmonary expansion. To secure this, a portal of reasonable size and stability must early be obtained, and is best secured by the partial subperiosteal single rib resection. This method makes possible the early restoration of the bony framework of the chest, which in children is an especially important feature for their future development.

The site selected for the incision should be a little below the middle of the largest area of flatness, regardless of other landmarks. Even in the most desperate cases, with the patient in a sitting posture and the weight of the upper extremity so distributed as to leave the sound side of the chest free for the necessarily increased respiratory effort, a light anæsthetic may be safely given, and an opening quickly made. The finger should then be rapidly passed about the pleural space to free all circumscribed areas or encapsulations of pus, and then two or three large fenestrated drainage tubes should be so placed as to reach every pocket. Where the writer is in doubt as to having reached all these pockets, an ordinary uterine probe is introduced and swept around between the two pleura quickly, securing the desired results; and a rubber tube in the jaws of the long uterine forcep placed well down in the depth of this newly opened space insures effective drainage from this point.

For the first five days there is no effort to remove these drainage tubes, nor to secure lung expansion; but a strong suction syringe is applied to the mouth of each tube several times a day, to withdraw the plugs of coagulated serum usually found in the early history of these cases. This is not so necessary where the empyemas are of longer standing and nothing but pus is found in the dressings.

If the tubes have been well placed and are large and have been kept free from fibrin plugs, it is usually possible to remove them on the fifth or sixth day. As soon as this is done, the time for the application of methods for lung expansion has arrived. If there is no direct communication with a bronchus, the application of the hyperæmic cup completely covering the opening, and kept in place for a half hour or more, combined with forcible expiratory effort by the patient, rapidly expands the damaged lung and drains the cavity.

In case the temperature rises and a new focus occurs after the removal of the tubes, the writer has been in the habit of carefully inserting a long blunt probe with a curved extremity which curve should conform to the contour of the

chest wall. This probe carefully directed down to the new focus and the two pleura separated, followed by application of the suction cup, has soon drained and closed this space.

When necessary, one may strap the hyperæmic cup in place over the opening and maintain a constant negative thoracic pressure, the patient being able to manipulate the bulb when necessary to increase the vacuum. It is surprising to see how quickly the incision closes under this treatment, being in the writer's experience not longer than seventeen days. In fact, in order that one may be absolutely sure that there is no pus remaining, it is sometimes necessary to separate the walls of the drainage site for several days prior to allowing it to permanently close. Where a persistent sinus and small cavity remains Ochsner⁸ recommends the injection of Beck's vaseline bismuth subcarbonate paste into the sinus opening.

In concluding this brief article, the writer desires to especially emphasize three points in the treatment of empyema thoracis:

First: The early attainment of an opening so located as to secure a large and free drainage, followed by the introduction of fenestrated tubes of sufficient calibre to quickly and effectually drain the cavity.

Second: The removal of these tubes at the earliest possible moment, after they have done their work, and

Third: The application of the Bier hyperæmic cup to drain the cavity after the tubes have been removed; this treatment to be continued until the lung is well expanded and the parietal pleura permanently closed.

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⁴ *Idem*, vol. iii, p. 296.

⁵ Keene's Surgery, vol. iii, p. 535.

⁶ Journal American Medical Ass'n., vol. xlix, p. 1672.

⁷ Journal American Medical Ass'n., vol. li, p. 803.

⁸ ANNALS OF SURGERY, vol. l, p. 151.

STUDIES OF PANCREATITIS AND THE PANCREATIC REACTION OF CAMMIDGE.*

BY JAMES TAFT PILCHER, M.D.

From the Pathological Laboratory of St. Mary's Hospital, Rochester, Minn.

THIS work has been undertaken in order to reach a more positive conclusion regarding the claims brought forward by Mr. Cammidge of London, that he was able to obtain a specific reaction in the urine of persons who are the subjects of pancreatic involvement.

In the series of cases here reported in which pancreatitis was said to have been present, only those have been so classified which were shown at operation to present such marked enlargement that a mistake in diagnosis was improbable.

The recitation of the involved test, or of the minutiae of technic is unnecessary here, except that it has only been through the development of the latter that the data for this paper has been made apparently worthy of publication. It is possibly because other observers have not sufficiently regarded the precepts of laboratory precision that they have obtained results so at variance with those of Mr. Cammidge. In the earlier work the profusion of positive reactions was astonishing. It was only after much experience that I learned to use nothing but distilled water in every step, including the washing of the glassware, a most important point.

The results of this early inaccuracy have been discarded and the cases which have been classified in Tables I and III are the only ones considered in these statistics. They represent the results of an improved technic, and all have been checked up by a control which was not boiled with hydrochloric acid (Fig. 5). If this showed a crystalline deposit,

* Presented before the Society of Clinical Surgery, Rochester, Minnesota, October 29 and 30, 1909.

Presented before the Kings County Medical Society, Brooklyn, New York, December 21, 1909.

and the one treated with hydrochloric acid did not, the test was regarded as negative.*

Between March and October of this year there were tests made on 62 cases, which were operated and a diagnosis of pancreatitis made from the gross appearance of the gland. The lesions in related organs were also noted (Table I).

TABLE I.

Group	Diagnosis	No.' Pos. Neg		
I.	Acute pancreatitis.			
II.	Subacute pancreatitis.			
	a. With obstruction of the common duct:			
	1. By stones in C. D. + H. D. + acute cholecystitis	1	1	0
	b. Without obstruction of the common duct:			
	1. Stones in G. B.	1	1	0
	2. Stones in G. B. + cystic duct.	1	1	0
	3. Stones in G. B. + cholecystitis.	1	1	0
	c. Infective	2	2	0
III.	Chronic pancreatitis.			
	a. With obstruction of the common duct:			
	1. By gall-stones.	7	6	1
	2. By gall-stones + stones in G. B.	2	1	1
	3. By gall-stones + stones in G. B. + cystic duct. .	1	1	0
	4. By gall-stones + stones in G. B. + cholecystitis. .	1	1	0
	5. By growth	4	4	0
	b. Without obstruction of the common duct:			
	1. Gall-stones in G. B.	16	11	5
	2. Gall-stones in cystic duct.	1	1	0
	c. Cholecystitis	7	4	3
	1. With stones in G. B.	6	5	1
	2. With pigment in G. B.	2	2	0
	3. With stone in C. D.	2	1	1
IV.	Atrophic pancreatitis.	2	2	0
V.	Cancer of the pancreas.	5	5	0
		62	50	12

* The following notes on the technic of the pancreatic reaction (*ref.* Robson and Cammidge: The Pancreas, Its Surgery and Pathology) may be of interest. The albumin is easily precipitated out. Sugar, if present, is removed by fermentation, which may take 48 hours or more. After 24 hours, fresh yeast should be employed and a phenylhydrazin test for sugar by the v. Jaksch or Kowarski method made before the solution is carried through the pancreatic reaction. In some of the cases the elimination of all traces of sugar has been difficult, but must be accomplished if any value is to be ascribed to the results.

Of these 82 per cent. (50 cases) showed positive reactions in the urine, and the remaining 18 per cent. (12 cases) were negative. In the group of subacute cases (6) all were positive, while in the group of chronic pancreatitis (49) we had 77 per cent. of reactions. Both of the cases of atrophic conditions and all of the cancers (5) showed typical crystalline deposits.

It would be well to define some of the terms used in the summary, both of the classification of pancreatitis and of the accompanying conditions. While of course it is impossible to make an accurate classification merely from the gross appearance of the gland, the following has been adopted as a working basis. By acute, is indicated general enlargement, soft with hæmorrhagic tendencies; by subacute moderate general enlargement, firmer than the former and accompanied by fat necrosis; by atrophic very little remaining gland tissue, and that very soft; sclerotic denotes a small very dense gland with general involvement. Chronic pancreatitis is self-explanatory, and its two pathological types are the interacinar or large smooth gland with general involvement, and the

In the second step, *i.e.*, adding lead carbonate, the hot hydrochloric acid solution should be perfectly cooled, as the reaction with the carbonate is violent if the solution is hot, and a film is formed on the sides of the beaker where reaction would not be complete; also that the resultant lead chloride is moderately soluble in hot solution. This reaction must be allowed to complete itself before filtering, usually three or four minutes.

The third step of adding tribasic lead acetate is an important one, as it serves to remove the glycuronic acid, which has been formed by boiling the urine with the hydrochloric acid (a mineral acid), if the specimen so treated contained glycuronates originally, which is frequently the case. The reaction should be allowed four minutes, being well shaken at half-minute intervals, the resultant filtrate should then be markedly decolorized and absolutely transparent.

The lead is then completely removed by precipitation as a sulphate, the solution having been rendered absolutely cool before filtration. Care must be taken that the neck of the bottle is cooled also.

All filter papers used should be washed with distilled water, and a small amount allowed to drain through in order to wash out the ever-present chlorides, which will precipitate the lead and cloud up the filtrate at certain stages.

interlobular or hard nodular gland, which is more apt to be localized.*

As it seems to have been shown that it is the disturbance of the internal secretion which bears the etiological relation to the production of the crystals in the urine, you are asked to bear this in mind as the observations are developed.

Of the 23 per cent. (12 cases) which gave negative reactions in the group of chronic pancreatitis, all were old standing cases, all were grossly of the interlobular type, and all but one localized in or near the head of the gland, the other being a general involvement; thus tending not to interfere markedly with the physiological action of the islands of Langerhans, either histologically because the islands are intralobular in situation, or with the one exception mentioned, because of being confined to relatively small areas.

It is also significant that in nine of the cases there was no obstruction of the common duct, five of them having stones in the gall-bladder only, the other four being complicated by cholecystitis, thus causing the pancreas the least irritation.

Is this irritation an etiological factor? Is it necessary that the stone be in contact with the gland in order to produce irritation? On the contrary, observations point to the other extreme. This is very noticeable in Group II. Here in six cases of subacute pancreatitis there was only one where there was obstruction by a common-duct stone, and that was complicated by an acute cholecystitis, and stones in the hepatic duct; and further in Group III among 49 cases of chronic pancreatitis there was obstruction of the common duct by stone in thirteen cases, or 27 per cent., and six of these were complicated by stones in the gall-bladder, cystic duct or cholecystitis.

It must be considered that interference with the hypo-

* While of course it is impossible to make an exact diagnosis of these two histological types without a histological examination, yet the glands grossly so resemble those on which histological examinations have been made that one would appear warranted in the above deductions.

thetical internal secretion of the pancreas, due to reflex irritation, may be the forerunner of pathological changes in the gland, either from stasis of the secretion or through its devitalizing effect predisposing to the subsequent infection.

What importance can be ascribed to the "pancreatic reaction" in this relation? There have been several cases where it has been positive, yet no gross change has been noted in the gland at operation; but the irritant factor (gall-stones or cholecystitis) having been removed, within two weeks after operation it has become persistently negative. While I appreciate the possibility that it may be due to a derangement of the liver that this substance is excreted in the urine (although many negative reactions and no positive ones have been obtained, where that organ was markedly involved, which would tend to eliminate this factor), may it not be assumed equally as well, if not more probably, that it was due to the reflex inhibition of the internal secretion causing a disturbance of the internal metabolism, correlated in cause and effect to the reflex stimuli noted so frequently in the stomach from gall-bladder or duodenal involvement, evidenced as a pylorospasm, hyperacidity or anacidity.

On the other hand, when the gross changes have occurred they may be so extensive as to have permanently injured the gland, and the internal secretion will be correspondingly insufficient. A few patients have returned for examination a year or so after operation, at which chronic pancreatitis was diagnosed, and have shown a positive reaction. They complain not of the original trouble, but of symptoms relevant to pancreatic derangement.

In 35 per cent. (20 cases) of this series, cholecystitis was present, introducing the infective factor. There are only a very few cases where infection is beyond doubt the only factor, and these are found in the group of subacute cases, and also in the instances of atrophic pancreatitis. In the entire series of 57 cases, excluding those of cancer (6), stones in the gall-bladder formed 49 per cent. (28 cases), while stone in the common duct *per se* and together with other factors formed 25 per cent. (14 cases); thus together we find stones in 74 per cent. of the cases.

In computing the percentages in the total number of cases of pancreatitis operated upon by Dr. Mayo, 293, excluding 28

TABLE II.—ETIOLOGICAL FACTORS IN PANCREATITIS.

Group	Diagnosis	Total
I.	Acute pancreatitis.	
	1. Stones in G. B.	4
	2. Stones in pancreatic duct.	1
	3. Cholecystitis	2
II.	Subacute pancreatitis.	
	a. With obstruction of common duct:	
	1. Stone in C. D.	2
	2. Stone in C. D. + H. D. + Acute cholecystitis.	1
	3 cholecystitis	4
	b. No obstruction of common duct:	
	1. Stones in G. B.	7
	2. Stones in G. B. + cystic duct.	1
	3. Stones in G. B. + cholecystitis.	12
	c. Cholecystitis	1
	d. Infective	2
III.	Chronic pancreatitis.	
	a. With obstruction of common duct:	
	1. By gall-stones.	32
	2. By gall-stones + stones in G. B.	22
	3. By gall-stones + stones in G. B. + H. D.	8
	4. By gall-stones + stones in G. B. + cholecystitis.	4
	5. By growth	9
	6. Infective	16
	7. Infective + stones in G. B.	2
	8. Stones in pancreatic duct.	1
	b. No obstruction of common duct:	
	1. Gall-stones in G. B.	75
	2. Gall-stones in G. B. + cystic duct.	4
	3. Gall-stones in G. B. + cystic duct + infection.	1
	4. Sclerosis	4
	c. Cholecystitis:	
	1. With stones in G. B.	39
	2. With pigment in G. B.	6
	3. With stone in C. D.	5
IV.	Abscess of pancreas.	3
V.	Cancer of the pancreas.	25
	1. Stones in G. B.	3
VI.	Cyst of pancreas.	1
		321

cases of cancer (Table II), stones in the common duct occurred in 74 cases, or 25 per cent.; stones in the gall-bladder 151

times, or 55 per cent., stones in one situation or another therefore being present in 77 per cent. of the cases. Cholecystitis was found in 98 cases, or 33 per cent., both as an independent factor and in conjunction with stones. These percentages correspond so strikingly with those in the smaller series (Table I) on which observations were made as to the presence or absence of the pancreatic reaction, that it would seem almost possible to transfer these results to the larger series.

From an anatomical point of view it is interesting to note that in 28 per cent. of the cases persistent jaundice was caused by the involvement of the common duct by the head of the gland. If to this is added the 25 per cent. representing the incidence of jaundice with stone in the ampulla, we would have 53 per cent., corresponding fairly closely with the 62 per cent. given by Helly in which he found the duct involved in the gland tissue in his cadaveric studies; but we are hardly warranted in disregarding the presence of the stone as the causative factor of the jaundice in all of the cases, although in some the pancreatitis was certainly caused because of the direct irritation of the stone on the surrounding gland substance, which probably accounts for the discrepancy in the percentages of incidence of gland involvement where only related portions of the biliary tract were affected, and where stone was found in the common duct, which is shown in the next observation.

In a series of 3095 operations by Dr. W. J. Mayo on the gall-bladder and biliary passages, pancreatitis was found in 293 cases, or 9.5 per cent.; approximately it occurred once in every 10 cases. In this same series there was obstruction of the common duct by stone in 394 instances, and an accompanying pancreatic in 74 of the cases, or 19 per cent.; approximately it occurred once in every five cases.

In order to find out further the degree of accuracy of this test, 50 consecutive cases were chosen in which clinically diverse affections of the biliary tract were diagnosed. Group

VI (Table III) shows what was found at operation. There were seven positive reactions obtained, or 14 per cent. In

TABLE III.

Group	Diagnosis	No. Pos. Neg.		
VI.	No pancreatitis.			
	1. Gall-stones in C. D.	5	1	4
	2. Gall-stones in G. B.	17	2	15
	3. Gall-stones in G. B. + C. D.	5	2	3
	4. Gall-stones in G. B. + C. D. + H. D.	3	0	3
	5. Gall-stones in G. B. + cholecystitis.	10	1	9
		—	—	—
		50	7	43
VII.	Miscellaneous—no pancreatitis	50	3	47
VIII.	Normal	25	1	24

the majority of these positive cases there were many clinical signs that would lead one to believe that the pancreas might be involved, but no gross change was found at operation. It is to be noted, however, that these cases were of comparatively recent development, and it is quite possible that the hypothesis of irritation with resultant inhibition of the internal secretion indicates to us the *modus operandi*, and that this had not been in effect long enough to cause gross glandular change.

In Group VII, (Table III) there are fifty cases representing analyses on as many surgical conditions of the upper abdomen. The three positive reactions were obtained from two cases of carcinoma of the stomach, inoperable because of their extensive metastases, and from a very advanced cirrhosis of the liver in conjunction with Banti's disease.

In Group VIII (Table III) are twenty-five observations on the urine of persons apparently in normal health, only one of which was positive, and this reaction could not be obtained in a subsequent analysis.

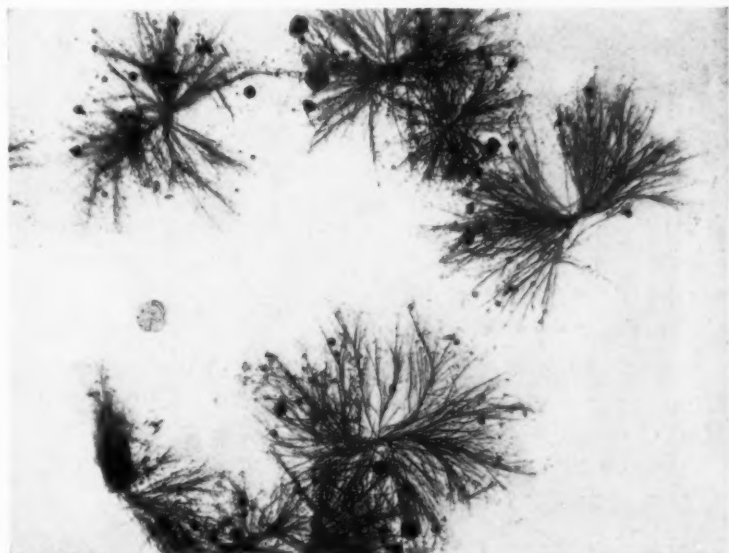
Heavy flocculent precipitates (Fig. 5) of typical crystals (Figs. 1 and 2) were noted to be rather indicative of general involvement, especially so in the group of subacute cases. While the more granular precipitates of the heavier broader crystals (Figs. 3 and 4) were found to occur more frequently in the instances of limited and moderate pancreatitis. These

FIG. 1.



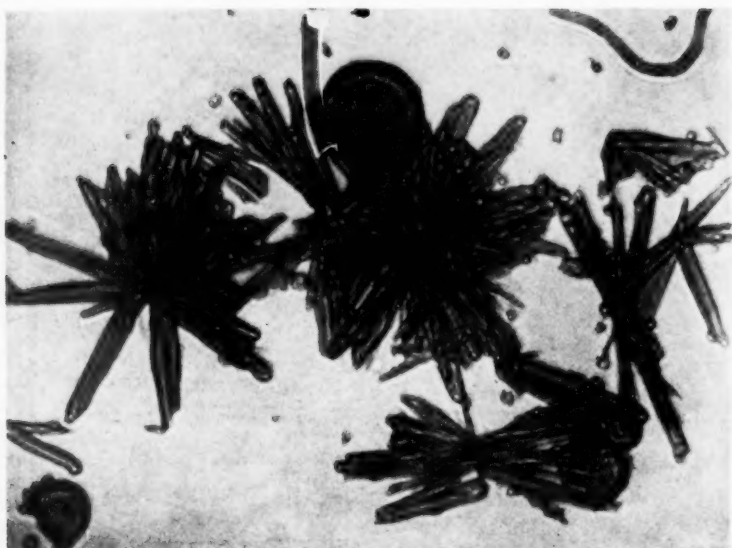
Typical crystalline deposits in case of general pancreatic involvement of interacinar type.

FIG. 2.



Typical hair-like or filiform crystals, showing sheaf formation in case of chronic pancreatitis with general involvement, of interlobular type.

FIG. 3.



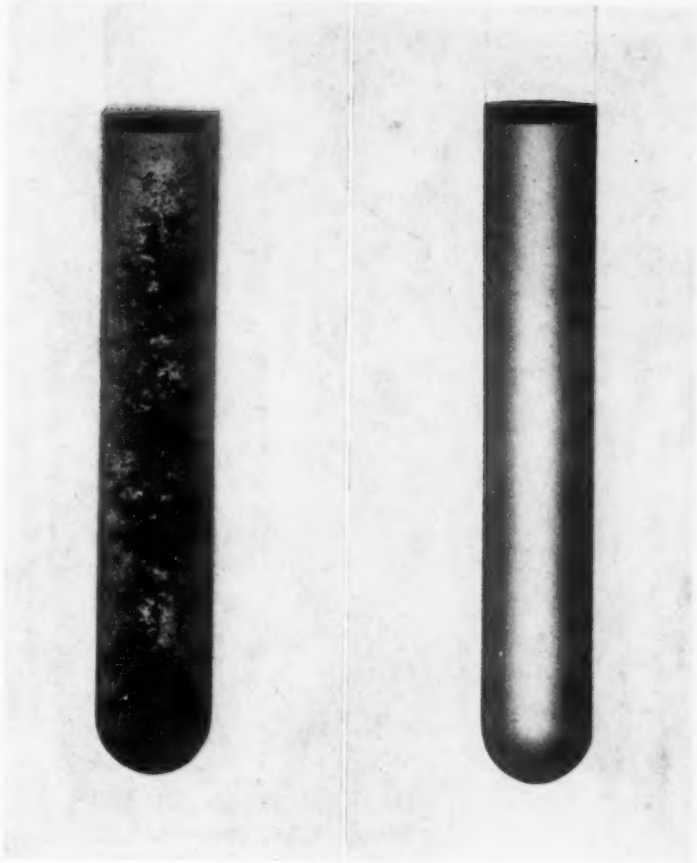
Acicular or saber type of crystals found in case of chronic pancreatitis with moderate involvement, of interlobular type.

FIG. 4.



Acicular crystal found in the heavy granular precipitates in cases of chronic pancreatitis with localized involvement.

FIG. 5.



Gross appearance of typical pancreatic reaction; heavy flocculent precipitate with a negative control.



observations are not by any means to be considered pathognomonic, and are suggestive only. Many hypotheses might be formed regarding the nature of the osazones forming these two types of crystals. Any statement of their structure must, owing to our present incomplete knowledge of the subject, be merely tentative. However, it seems that if investigations were pursued along the lines of the disturbance of the internal metabolism rather than attempting to account for the phenomenon through absorption of some substance from the gland itself, more progress could be made. The rapid disappearance of the reaction post-operative would seem to be fairly presumptive evidence that we have not to deal with simple absorption, as in that short period of time it is difficult to conceive of an entire regeneration of the pancreas, but rather with an incomplete catabolism in the blood.

EXPERIMENTAL DATA.

In order to determine whether the conclusions regarding the etiological factor played by the lack of internal pancreatic secretion both temporarily and permanently have more than a hypothetical basis for the production of these crystals in the urine, Dr. George Eusterman and myself undertook some dog experiments.

The dogs chosen were adult males, and in each instance were treated in one of the following four ways: (1) Segmental ligation, in which the gland substance was tightly constricted for its entire length at intervals of one and a half to two inches, the head and excretory ducts being left intact and patent; with the idea that there would be a temporary interference with the internal secretion and a permanent occlusion of the external secretion except that which could be obtained from the two inch segment containing the head and excretory ducts; and that the internal secretion would be renewed after the temporary sectional œdema had subsided. (2) Peripheral ligation; or the complete stoppage of all efferent and afferent vessels permanently, which was accomplished by throwing contiguous ligatures around the entire periphery of the gland, by which procedure the fact was expected to be established that it was not from any absorption of the gland

substance but because of a lack of its internal secretion that the pancreatic reaction was obtained in the urine. (3) Partial extirpation; usually of the right half of the gland. (4) Total extirpation, by which it was desired to control the reactions obtained from peripheral ligation and eliminate the factor of fat splitting in the necrosed areas.

In Group I (Table IV) we find the reaction appearing between 24 and 48 hours and ceasing about the 96th hour, at which time we may assume the resumption of the internal secretion, after the subsidence of the local reaction. These dogs recover completely their normal health.

TABLE IV.—SYNOPSIS OF DOG EXPERIMENTS.

Group	Reaction ante operation	Reaction 24 hours post operation	Reaction 48 hours post operation	Reaction 72 hours post operation	Reaction 96 hours post operation	Reaction 120 hours post operation
I. Segmental ligation	—	—	+	—	—	—
II. Peripheral ligation	—	+	+	+	+	—
III. Partial extirpation	—	+	+	+	+	+
IV. Total extirpation	—	+	+	+	+	+

In Group II (Table IV) the reaction is exceedingly prompt, especially if the operation is done during the period of active absorption from the bowel, as is evidenced by the lymphatics being full of chyle, and it remains permanent to death, which occurs usually between the twenty-fourth and forty-eighth hour. Glycosuria intervenes in the interim, immediately, if the above-mentioned absorption is going on. Postmortem extensive and active fat necrosis is always found, being more marked the longer the dog lives, a few hours making a great difference. Careful examination has failed to reveal any rupture of the enveloping serous membrane by the gland, although it is very tense and swollen, which would tend to the deduction that the ferments escape into the free peritoneal cavity by transudation.

In Group III (Table IV) the reaction is liable to be

delayed somewhat because of the secretion obtained from the uninjured one-half of the gland; but when once established is persistent until death, which occurs in from two to four weeks or longer from malnutrition. Toward the last, however, the dogs in this series refused to eat, and then only did the reaction fail. At postmortem the bowels were completely empty and the remaining portion of the gland enormously hypertrophied.

The results in Group IV (Table IV) are exactly comparable to those of Group II, except that the dogs lived a day or so longer, perhaps accounted for by the elimination of the toxic tryptic ferment. Proof that the fat necrosis was not the etiological factor is also hereby demonstrated.

Previous to each operation negative pancreatic reactions were obtained in every dog. The urines were all obtained uncontaminated, either by catheter or by being caught. The controls in every instance were negative. The typical stools and the rapid development of emaciation and languor have formed perfect clinical pictures when the animal lived long enough to develop this condition, as in Group III.

It would seem from these experiments outside of their value as corroborative evidence, that there is some abnormal substance excreted in the urine in cases of deranged internal secretion of the pancreas, that the gland proper is not absolutely essential to the well being of the dog, if its destruction is accomplished gradually, but that the internal secretion which seems to originate from the islands of Langerhans is most vital. It is not difficult to draw similar conclusions from an analogous condition in the human, namely in cases of atrophic pancreatitis; here the gland tissue is practically nil, but the islands of Langerhans seem to be intact if one might judge clinically, for the excretion of the substance giving the pancreatic reaction is certainly stopped after elimination of the irritant factor by operation, the patients recovering in a very short time a condition of health which they had not enjoyed for many months.

The most plausible explanation why these bodies which secrete their as yet hypothetical product internally are not destroyed at the same time as the remainder of the gland, is

that they receive an entirely different nerve supply from the sympathetic, and for the same reason it might be inferred that their secretion would be more liable to be disturbed by either direct or reflex irritation.

These observations certainly seem to illustrate rather aptly the remarks of Dr. W. J. Mayo to the effect that "the surgeon cannot intelligently operate upon organs of double function without a full knowledge of their internal as well as their external secretions, for therein may lie the cause of the failure of a mechanically well executed operation to cure the patient."

Conclusions.—While the above experiments and observations are of course too few to be considered final, the following conclusions may be tentatively made. Briefly the appended data indicates the premises and the deductions.

1. There is some substance excreted in the urine in cases of pancreatic irritation, as shown by the pancreatic reaction (dog and man).

2. The external secretion is not responsible for it (dog).

3. Therefore there must be an internal secretion (dog).

4. Interference with its production causing therefore a disturbance of the internal metabolism (dog).

5. The catabolism in the blood not being complete the substances are excreted as foreign bodies in the urine (dog).

6. In atrophic pancreatitis the pancreatic reaction is positive before operation (man).

7. At operation the irritant or etiological factor of the condition is removed (man).

8. After operation the pancreatic reaction disappears within a few days (man).

9. In a few days the pancreas is incapable of completely regenerating itself (man).

10. Therefore the same conclusions seem warranted in the human as were reached in the dog (*ref.* 3, 4 and 5).

11. That the internal secretion is produced by the islands of Langerhans, or some other pancreatic structure (man and dog).

12. That while the pancreas proper may be greatly degenerated these islands probably remain intact (man and dog).

13. That when there is no irritation these islands continue to secrete and no pancreatic reaction is found (man).

14. That irritation causes inhibition of the secreting properties of these islands, evidenced by the pancreatic reaction (man).

15. That removal of this irritation allows the patient to recover health (man).

16. Therefore the external secretion of the pancreatic gland is not more essential to either human or dog than the internal secretion.

Analytical.—1. In 62 cases of pancreatitis the urinary reaction was positive in 82 per cent. and negative in 18 per cent.

2. Positive reactions were obtained in all cases of subacute and all of the more marked chronic types of pancreatitis.

3. The negative results were obtained in cases of moderate localized chronic pancreatitis of interlobular type.

Statistical.—1. 293 cases of pancreatitis, stones were present in 77 per cent.; 52 per cent. in the gall-bladder and 25 per cent. in the common duct. Cholecystitis was marked in 33 per cent., *per se* and plus other factors.

2. In 3095 operations on the gall-bladder and biliary tract 9.5 per cent. of the cases were accompanied by gross changes in the pancreas. In 394 operations in which stone was found in the common duct 19 per cent. were accompanied by gross changes in the pancreas.

Inferential.—1. The disturbance of internal secretion of the pancreas is responsible for the pancreatic reaction; that this may be effected by reflex irritation as well as by direct, which may prove the forerunner of gross changes in the gland.

2. A typically positive reaction with a negative control is almost pathognomonic of pancreatic derangement. The converse is not shown.

My thanks are due to Dr. W. J. Mayo for suggesting the above study and placing at my disposal his clinical material; to Dr. L. B. Wilson, Director of the Pathological Laboratory, for his advice and personal interest, and to Dr. George Eusterman for his valuable assistance in the experimental work.

PARALYTIC ILEUS AS A SEQUEL OF FRACTURED RIBS.

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THE rarity of this condition, and its importance when it does arise, combine to make the following cases worthy of interest. The facts set forth may also afford some addition to our knowledge of the neuromuscular mechanism of peristalsis of the small intestine. That this is mainly influenced by its own peculiar nervous system contained in Auerbach's and Meissner's plexuses has long been known, and the fact that the vagus contains accelerator, and the splanchnic nerves inhibitory fibres, which are capable of influencing peristalsis to a marked degree, is also recognized. The results of their investigation into the mechanism of peristalsis, and the influence of vagal and sympathetic nerves on the movements of the small intestine, were published by Bayliss and Starling* in 1899, and the effects of stimulation of the splanchnics were summed up by Starling† as follows: "Stimulation of the splanchnic causes complete relaxation of the lower part of the ileum with the rest of the small bowel, but it produces a strong contraction of the muscle fibres forming the ileo-colic sphincter." We have thus conditions favorable for the production of the clinical signs of small intestine obstruction, and it remains to be seen whether the following cases can be explained on the theory of splanchnic irritation and stimulation.

The two cases here described were both admitted to St. Thomas's Hospital under the care of Mr. H. Betham Robinson, and I am indebted to him for permission to publish them.

* Journal of Physiology, xxiv, 1899.

† Recent Advances in the Physiology of Digestion, 1906.

CASE I. (Fatal.)—G. V., male, æt. 66, interpreter.

Previous History.—With the exception of having passed blood *per rectum* on two or three occasions the patient's health had been excellent.

History of Present Illness.—Three days before admission to the hospital, on June 19, 1907, the patient fell against some banisters and fractured several ribs on his right side. The affected side was efficiently strapped by his general practitioner, who saw the man once or twice again after the accident. Before the fall the patient's bowels had acted with regularity, but after it they refused to act, although aperients and three enemata were administered. Vomiting set in on the day of admission, and at first the vomit was bilious in character, but as its frequency increased the color had been observed to become darker,—so that when admitted the patient was bringing up black vomit. There was slight abdominal pain.

Examination.—The patient was a healthy looking man with excess of fat all over the body. His tongue was very dry, pulse rate 120, respirations 40, temperature 99.6° F. The abdomen was generally distended, but the distention was more noticeable centrally than in the flanks. There was no visible peristalsis. On percussion a tympanitic note was obtained all over the abdomen with no trace of dullness in the flanks; the liver dullness was diminished. There was some tenderness caused by pressure in the region of the left iliac fossa. Rectal examination negative. There was evidence of fracture of several ribs on the right side of the chest, as shown by marked local tenderness over the lower four ribs close to their angles. The situation of the tenderness was also sharply defined when pressure was applied on the anterior extremities of the ribs. No crepitus, however, could be detected. There was no evidence of lesion of lung or pleura on either side. A diagnosis of intestinal obstruction was made, and, although there was little but the local left-sided tenderness to warrant it, the primary lesion was thought to be a carcinoma of the iliac colon.

Operation.—Performed shortly after admission, under chloroform anæsthesia. The abdomen was opened through the right rectus, but no lesion save distended bowel could be discovered; the distention chiefly affected the small bowel, and the cæcum and colon were only moderately dilated. There was no free fluid and

the distended coils of small intestine prevented complete examination of the descending colon. A left-sided incision was therefore made, but no further lesion could be discovered except a slight abnormality in the attachment of the mesosigmoid. That this in no way accounted for the obstruction was clear from the fact that the descending colon was not distended. The absence of any cause for obstruction in the rectum or pelvic colon was further demonstrated by the passage of a rectal tube which was easily felt through the abdominal wound in the lumen of the bowel after it had passed 8 to 9 inches from the anus. A little gas and fecal matter escaped. As no sign of organic obstruction could be discovered the abdominal cavity was closed in layers.

After the operation the patient showed signs of profound shock, and, while the abdominal distention was markedly decreased, his general condition was far from satisfactory. The stomach contents were vomited and the man complained of abdominal pain; there were no signs of peritonitis, but there was marked thirst,—the tongue became very dry, and the patient's mental condition was abnormal. Turpentine enemata were administered but these yielded no result, and were in fact retained, showing that the large bowel would not respond to the ordinary stimulus of fluid distention. Ten ounces of hydrogen peroxide (10 volumes per cent.) were then used as an enema, and this, which caused more sudden stimulation of the bowel, produced an evacuation of flatus and fecal matter, and the patient expressed his relief. However, mental depression was still a marked feature of the man's condition, and he stated that he was about to die, which in fact he did, although his vomiting had ceased and a satisfactory action of the bowels had been obtained, some 48 hours after operation.

Post-mortem examination, by Dr. W. O. Meek. The small bowel was greatly distended and so also was the cæcum, while the colon was collapsed. The pelvic colon had a mesentery which was more vertical than usual in its attachment to the posterior abdominal wall. There was no obstruction to the lumen of the bowel and no hypertrophy of the muscular coat. There was excess of abdominal fat. The peritoneum was healthy. The eighth to the eleventh ribs on the right side exhibited ununited fractures in the region of their angles; there was little callous formation. The pleuræ and pericardium were healthy. The heart was pale

and flabby, the valves healthy. Lungs emphysematous and congested at the bases. The remaining organs exhibited no noticeable lesion, and there was no trace of a hernial sac in any of the usual situations.

That the condition might be due to what has been termed "angulation of the sigmoid" occurred to me during the course of the operation, but the absence of distention of the colon negatived the possibility of this explanation. The case thus appears to have been one of paralytic distention going on to the production of acute intestinal obstruction and causing death from toxæmia.

CASE II. (Recovery.)—J. C., male, æt. 60, bricklayer.

History.—On the day of admission, August 12, 1908, the patient, who was a fat bronchitic subject, fell from a ladder a distance of 18 feet, on to some sacks of cement, thereby fracturing the eighth and ninth ribs, close to their angles, on his right side, and causing severe contusions to his back. There was no evidence of hæmothorax or other lesions.

He was placed in bed and treated for his bronchitis by expectorants, with a steam-kettle by the bedside. The patient's breathing was somewhat labored and his color was not good. Twenty-four hours after admission he stated that he felt much easier, and there was slight mucopurulent expectoration. There were rhonci and a few crepitations heard over both lungs. However, on the third day it was observed that the man's abdomen was unduly distended, and his respirations, which were 32 per minute, were more labored than ever, and his general condition was not so good as it had been. Two turpentine enemata were given to relieve the distention, but these were returned, and the patient passed only a little flatus with a very little fecal matter. The bowels had not acted since admission. On the fourth day it became clear that active measures must be taken to relieve the abdominal distention and lessen the respiratory embarrassment. There was at this time extreme central distention of the abdomen, with a tympanitic note on percussion over it; no sign of free fluid in the flanks; tongue dry; anxious facial expression; rapid and feeble pulse. The patient was greatly distressed by hiccough and once or twice he vomited stomach contents. There did not appear to be any

distention of the colon, and there was no visible or audible peristalsis; rectal examination revealed no cause for obstruction.

The clinical picture was one of intestinal obstruction, and as enemata and the passage of a long rectal tube had afforded no relief, some operative measure was clearly called for. The man was in no condition for the administration of an anæsthetic as he was markedly cyanosed and his pulse was rapid and feeble. It was decided to try the effect of puncturing the bowel through the abdominal wall with a hollow needle. This was effected at the site of the greatest distention—in the middle line, above the umbilicus—with a small exploring needle. A quantity of gas escaped and a little fluid fecal matter was ejected; the size of the abdomen was greatly lessened, and the patient experienced a sense of great relief, and said that he was almost comfortable. This treatment was followed up by the injection of eserine salicylate gr. 1-50 into the buttock at four-hourly intervals. After two doses the bowels acted twice and the man was greatly relieved. This improvement, however, only lasted for about sixteen hours, and at the end of this time his condition was as bad as before,—so that a more permanent method of relieving the distention of the small bowel became imperative. In the same situation as that selected for puncture an incision was made under local infiltration anæsthesia, and a coil of small intestine, blown up firmly against the parietal peritoneum, was exposed. Owing to the taut condition of the bowel wall even the smallest Paul's tube could not be sutured in position, so a very small opening was made and a winged rubber catheter was tied into the bowel. A few stitches were put in to hold the bowel and the parietal peritoneum in contact. Gas and fecal matter escaped, and, as the latter tended to block up the tube, this was filled with water, and by means of syphonage, a good deal of both fluid fecal matter and gas were evacuated. This relief of the distended bowel again allowed the muscular coats of the bowel to contract, and peristalsis recommenced, causing an evacuation *per rectum* three times in the succeeding 24 hours. The production of this small fecal fistula to all appearances saved the patient's life, and it seems clear that the same procedure should have been adopted in Case I.

Both gas and fecal matter continued to escape for about three weeks, after which time there was only an occasional whistling of gas through the wound, and the latter eventually closed firmly

at the end of the eighth week. Two days after the operation the patient was comfortable and his abdomen was of normal size. No eserine was administered after the second operation. It was not possible to tell which part of the small bowel was opened.

If due consideration be paid to the history of these two cases and the clinical phenomena which they presented, the conclusion at which one arrives, I think, is that both patients were suffering from paralysis of the small bowel, and, as to the cause of this, I have suggested above that it may have been due to splanchnic irritation. Starling states that every part of the small intestine receives fibres indiscriminately from the splanchnics of both sides, and that the stimulation of this nerve on either side produces the same effect, namely, inhibition of peristalsis. He further states that such paralysis of the gut has occurred in cases of gunshot wounds of the abdomen, probably from splanchnic irritation and stimulation, unaccompanied by injury to the intestine itself. It is true that the fracture of the ribs in both these cases was situated in the neighborhood of their angles, whereas the thoracic ganglia from which the splanchnics arise lie close to the heads of the ribs; but it may reasonably be supposed that some displacement of the proximal fragments occurred, sufficient to irritate the sympathetic chain, either directly, or through the rami communicantes connecting the sympathetic ganglia with the spinal nerves. In both cases the great splanchnic nerve of the right side would be the one involved, as this arises from the sixth to the tenth thoracic ganglia, and in one case the eighth and ninth ribs were broken, and in the other the eighth to the eleventh. In one case, it is true, the patient fell a distance of 18 feet, and this may have caused a severe abdominal contusion or concussion, and, experimentally, if both splanchnic nerves be intact a blow on the bowel will cause inhibition of its muscular coats all along the length of the intestine,—and herein may lie the true explanation of the beginning of a condition which finally terminated in paralytic obstruction. Paralytic distention of the small bowel

is fairly commonly met with after operations for strangulated hernia, resections of bowel, and other operative procedures, and the initial stagnation of the bowel contents leads the way to actual obstruction if no relief is afforded. The sequence of events in such cases is amply illustrated by my second case. Here the peristaltic paralysis favored the accumulation of gas from putrefactive changes in the small bowel, probably the ileum, for here the bacteria are more numerous than in the jejunum, and the over distention made it still further impossible for the bowel to contract even had it recovered from splanchnic irritation and inhibition. In both cases the extreme gravity of the condition was not apparent until the third day after the accident, and during the interval between the cause and the very serious effect, gas from putrefaction had been generated within the lumen of the bowel.

The paralyzing effect of abnormal distention is well shown in acute dilatation of the stomach, where vomiting occurs at the onset of the condition but frequently ceases as the distention progresses,—and this accounts for the fact that the clinician may easily overlook the lesion unless he makes a repeated and careful abdominal examination. In the case of the stomach, emptying the organ by lavage will effect a cure if the condition be recognized early,—and so, in my second case, giving vent to the distending gas in the small intestine by puncture with a hollow needle, not only relieved the patient from his respiratory embarrassment for sixteen hours, but favored peristalsis to such an extent that two actions of the bowels rapidly ensued. The administration of two doses of eserine salicylate gr. 1-50 into the buttock did undoubtedly help in producing this peristaltic action; but that it was not the main factor in producing it is suggested by the fact that the drug was not used again after the small ileostomy opening had been made at the second operation. The risks of thus puncturing the bowel through the abdominal wall, when in a state of extreme distention, do not appear to be very great, as a return to the high intra-intestinal pressure did not cause any further leakage of contents, and, when

the needle was withdrawn its track must have closed immediately. The type of needle used was just such as one is accustomed to use in the search for pus in a case of suspected empyema.

The good effect of this intestinal puncture was only temporary; re-accumulation of gas caused a return to the high intra-intestinal pressure against which the muscular power of the bowel wall was powerless, and it is clear that such a condition is not amenable to treatment by aperients or enemata. The former act either on the musculature of the bowel wall—which is too heavily handicapped to be able to respond—or on the glandular layers, increasing the fluid in the intestine,—and this is not likely to help in the discharge of this fluid if the muscle be paralyzed; enemata act mainly on the large bowel, and only secondarily on the contractile power of the small intestine: and this accounts for the fact that success with enemata in cases of peritonitis is no criterion of a favorable prognosis.

The operation of ileostomy is one which surgeons hesitate to perform for several reasons, even in cases of paralytic obstruction. First, on account of the grave condition of the patients in whom it is likely to be required; secondly, because, if the opening be made high up in the small intestine, the patient may go down hill from inanition before the bowel can be closed, this second operation being often delayed on account of the soreness and autodigestion of the tissue around the artificial opening. These objections, I think, hold in cases of paralytic ileus only where a general anæsthetic is used, and where some such apparatus as a Paul's tube is used to effect the opening into the bowel.

Now, if the opening we propose to make in the bowel be small there can be little objection to an incision in the middle line, and local anæsthesia by infiltration or any other method will certainly suffice for the operation. The incision should be close to the umbilicus, for it is here that the distended coils of ileum are usually situated in such cases, and the risks of subsequent hernia are less above than below the um-

bilicus. The visceral peritoneum will be found to be insensitive and a purse-string suture can easily be placed in position and a winged rubber catheter of about size No. 12 can be secured; a few seromuscular sutures may then be put through the slackened bowel and the parietal peritoneum. This procedure succeeded admirably in my case, and in view of the fact that the contents of the bowel are gas and very fluid fæces I see no reason to need a larger opening.

The relief required to overcome this state of paralysis is only temporary, and the main object of the operation is to provide for the safe exit of the imprisoned gas. If peristalsis is re-established the intestinal contents will find the normal route easier than that through the catheter, so that there is very little likelihood of the opening failing to close spontaneously if the catheter be removed after a few days. If the tube should become blocked with fecal matter, syphonage with water will usually clear it. It may be that I was fortunate in the case described above in placing the catheter in the right portion of the bowel; but if one such aperture failed, I see no objection to a second, made under similar conditions, the safety of the procedure resting on the fact that if only a small opening be made in the bowel wall there will be a rush of gas and not of fæces, as that portion of the gut close to the parietal peritoneum is sure to be blown up against the abdominal wall with flatus, and the catheter can be secured in position before any fecal matter is ejected.

Performed on these lines I feel convinced that ileostomy should more often be performed than it is for the relief of paralytic distention of the bowel, whatever the primary cause of this condition may be, whether peritonitis be present or not. Such an opening as this will, as a rule, close spontaneously, but if not, the closure of so small a fecal fistula should not be a matter of any difficulty as soon as the condition of the patient warrants a further operation.

FIBRINOUS CALCULI IN THE KIDNEY.

BY HOMER GAGE, M.D.,
AND
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OF WORCESTER, MASS.

IN the ANNALS OF SURGERY for September, 1908, we reported a case under the above title, with some references to the literature of the subject. Since then the patient has died, and the results of the postmortem examination, especially so far as they relate to the condition of the genito-urinary tract, seem of sufficient interest to warrant a brief record. The kidney was removed June 1, 1906. In January, 1908 the patient had influenza, in February tonsillitis, and on March 12, 1908 she entered the hospital with a diagnosis of pleurisy, remaining until April 4. She returned to the hospital September 23: at that time she had pain in the left hypochondrium with constant nausea, vomiting and much diarrhoea. She died October 18. The following is an extract from the autopsy record:

Body length 5 ft. 6 in. Estimated weight 120 pounds. Color of skin sallow, suggesting bronzing. *Rigor mortis* present. Scattered over the body everywhere are minute punctate hæmorrhagic areas. Slight œdema of both limbs. A large cicatrix at base of toes on dorsum of left foot; another cicatrix just below middle of right leg on inner side, $\frac{5}{8} \times \frac{3}{8}$ inches. Abdominal fat is 1 inch in thickness. Omentum bound firmly to top of bladder along edge of right rectus (stomach bound to scar from gall-bladder operation). Foramen of Winslow obliterated. Stomach adherent to pancreas.

Appendix normal.

Kidney.—Peritoneum thickened and fibrous over kidney. Left ureter apparently normal. Right ureter (much enlarged) full of hard material. On section kidney shows infarcts—slight pyelitis.

Heart dilated; muscle soft and light colored. Left ventricle much dilated, contained clots. Partly organized thrombi.

Lungs.—Edematous.

Liver.—Moderate nutmeg liver.

Arteries.—Moderate general arteriosclerosis. Thrombosis of left renal artery.

Bladder.—Full, apparently normal.

Anatomical Diagnosis.—General arteriosclerosis; myocarditis; dilated heart; general abdominal adhesions; renal infarcts.

The vagina, bladder, uterus, both ureters and the remaining kidney were removed in one piece and sent to Dr. Thomas Ordway of the laboratory of the Boston City Hospital, from whom the following report was received:

"Specimen received (see Fig. 1) consists of female genitalia and bladder to which, on the left, a considerably enlarged kidney containing numerous infarcts is attached by the left ureter and left ovarian vein. These appear normal. On the right, the kidney is absent and the proximal portion of the ureter is fastened to a small mass of skin and subcutaneous tissue. The right ureter is irregularly and markedly thickened, particularly in the middle portion. (Fig. 1.)

"The thickened portion of the right ureter (see Fig. 2) has an irregular, nodular appearance and firm consistence. It is covered with numerous fibrous tags. Above and below the thickened portion the ureter is of more normal size.

"On opening the ureter it is found distended with numerous masses of very friable material which easily falls to pieces, giving it a distinctly granular appearance (Fig. 3)."

"A portion of the ureter and contents (Fig. 3) was taken for microscopical examination. The wall of the ureter and the enclosed concretion were embedded in celloidin, then put into acid alcohol for a short time, as concretion contained a few spicules of gritty material. The portion remaining on the block after sectioning was photographed in gross under alcohol (Fig. 4). The thickened wall of the ureter is shown and the concentric markings of the concretion are evident. Microscopical sections show marked chronic inflammation of the ureter (Fig. 5, a). The concretion is made up of concentric laminæ composed of fibrin in the form of threads and network, in the meshes of which are many polymorphonuclear leucocytes and lymphoid cells."

The result of an additional diagnosis (microscopical), was: "Multiple fibrinous concretions in ureter. Chronic ureteritis."

FIG. 1.



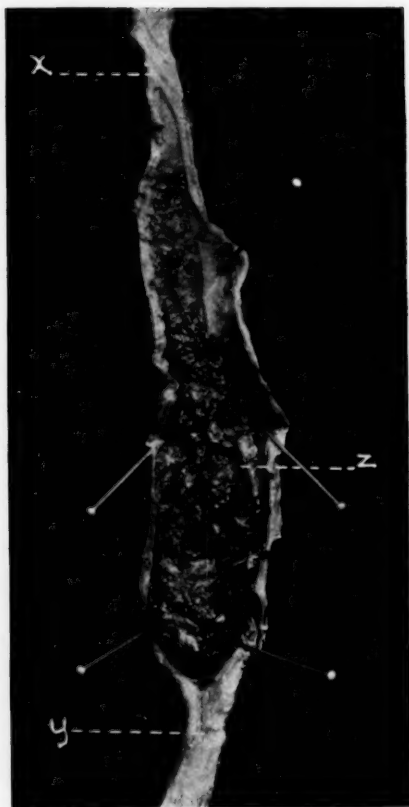
Photomicrograph showing left kidney, *a*, considerably enlarged; the ureter, *b*, and ovarian vein, *c*, are shown, leading respectively to the bladder, *d*, and ovarian region. On the right, at the proximal end of the ureter, is a small mass of tissue consisting of skin and subcutaneous tissue, *e*. The right ureter is shown markedly and irregularly thickened and tortuous. The irregular thickening is most marked at about the middle portion between *x* and *y*. (About quarter natural size.)

FIG. 2.



A detail of Fig. 1 from *x* to *y*, showing thickened portion of right ureter having an irregular, nodular appearance and covered with numerous fibrous tags. Above and below the thickened portion the ureter is of normal size. (Magnified one and one-quarter times.)

FIG. 3.



Enlarged portion of right ureter opened longitudinally, showing the lumen filled with nodules and masses of friable material. (Magnified one and one-quarter times.)

FIG. 4.

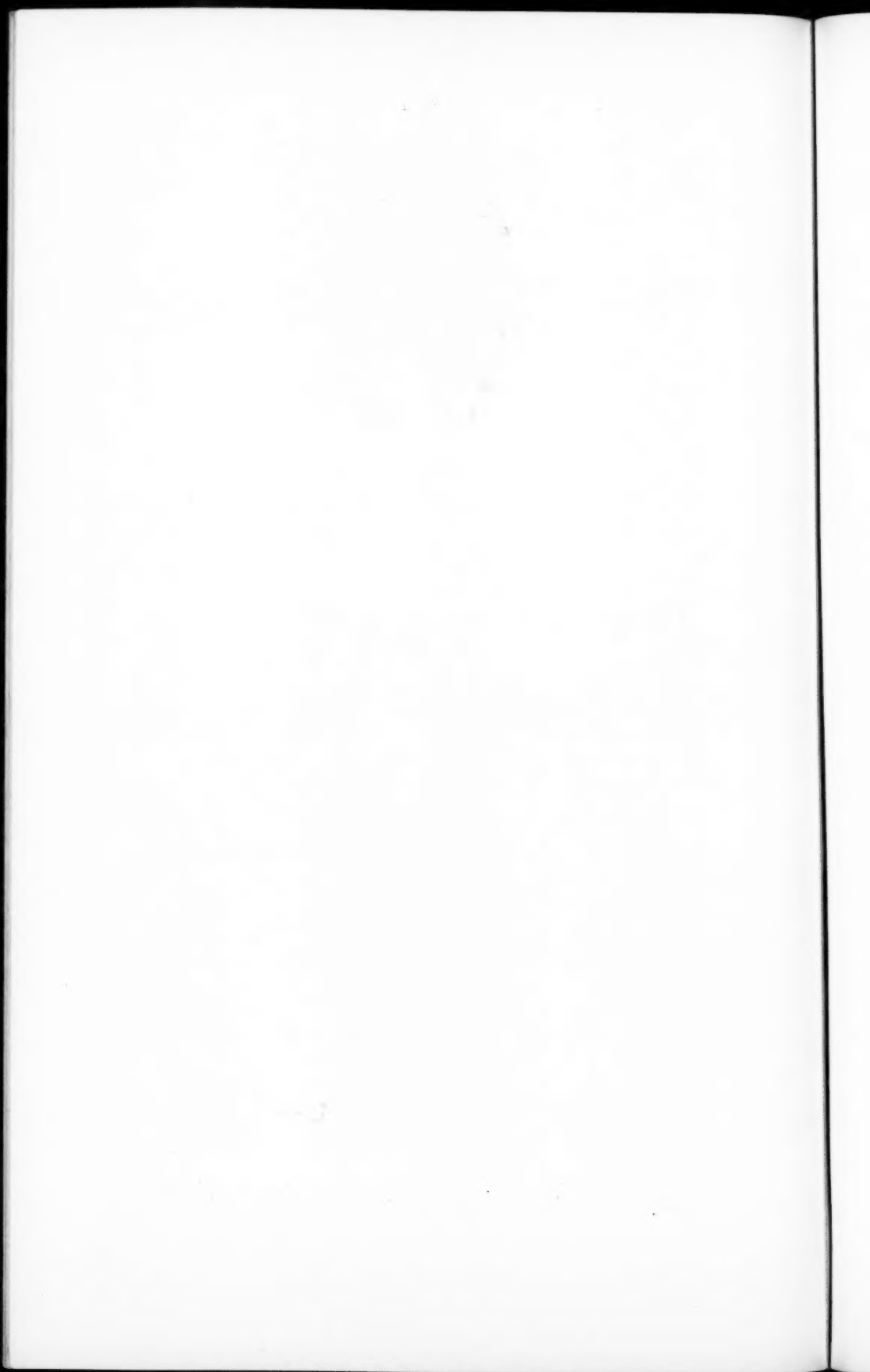


Cross-section at *z*, Fig. 3, showing portion of wall of ureter, *a*, and enclosed concretion, *b*, the concentric markings of which may be seen.

FIG. 5.



Microscopic section from "block" shown in Fig. 4. Wall of ureter showing chronic inflammation is seen above and to the left of the dark, laminated mass which represents the fibrinous concretion.



TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, October 13, 1909.

The President, DR. JOSEPH A. BLAKE, in the Chair.

UMBILICAL CORD HERNIA: OPERATION ELEVEN HOURS AFTER BIRTH.

DR. WILLIAM A. DOWNES presented an infant, five weeks old, which was brought to the Babies' Hospital on September 7, 1909, a few hours after birth. Examination showed a congenital umbilical cord hernia, about the size of a child's head.

Operation was done eleven hours after birth. The child was given a whiff of ether, and the thin sac, which was composed of amnion and a peritoneal lining, was incised at the junction of the sac with the abdominal wall. The sac was filled with small intestines surrounded by clear serum, and upon evacuating this the small intestines were easily reduced. There was no Wharton's jelly between the layers of the sac. There were no fistulous tracts nor adhesions. The child made an uneventful recovery.

In connection with this case, Dr. Downes showed the sac, which had been excised, and also photographs of the child before and after operation (Figs. 1 and 2).

DR. HOWARD LILIENTHAL asked Dr. Downes what proportion of these cases recovered? This was the first case of this congenital form of hernia that he had ever heard of to get well. Usually, the contents of the hernial sac were such that they could not be returned into the abdominal cavity. In a case that he saw at Mt. Sinai Hospital about a week ago the child promptly died after operation.

DR. DOWNES said he had found the history of two cases that had been seen at the Hospital for the Ruptured and Crippled. One of these was operated on by Dr. William B. Coley about 23 hours after birth, and recovered. In that instance the peritoneal

cavity was not entered, the contents were reduced and the edges of the skin at base of sac freshened and brought together over sac. The other case was moribund when it was brought to the hospital.

One writer, Dr. Downes said, had reported over 90 cases, in which laparotomy had been performed with 65 recoveries. In many of these cases the hernial sac contains the liver or other abdominal viscera, and this makes the outlook very unfavorable.

TUBERCULOUS CHONDRITIS AND MASTITIS SIMULATING CANCER.

DR. ALFRED S. TAYLOR presented a woman, 22 years old, who in 1904 had an abscess in the left axilla which was said to be tuberculous.

Following this she remained in good health until January, 1908, when she received a contusion of the right breast which about two months later began to give her considerable pain, and on rubbing the breast she happened to notice a lump within it.

When Dr. Taylor first saw the patient, in June, 1908, she had a tumor along the lower border of the right breast which had many of the characteristics of carcinoma. It was perceptible to the eye, hard, nodular and infiltrating. It was quite firmly fixed to the underlying structures, but not adherent to the overlying skin. There was no tenderness and no palpable enlargement of the axillary glands. The general characteristics of the growth were very suggestive of carcinoma.

Against the diagnosis of carcinoma was the unusual site of the tumor, at the lower edge of the breast in the nipple line, the fixation to the deeper structures without involvement of the skin, and the absence of axillary involvement.

When under ether, a trocar and cannula was inserted into the tumor, but no fluid was withdrawn. After the withdrawal of the needle a few drops of creamy pus exuded from the skin puncture, thus establishing a diagnosis of non-malignancy. A circumferential incision was then made and the breast turned upwards, disclosing a tuberculous mass with thickly infiltrating walls. The cartilage of the sixth rib and a portion of the adjacent rib were involved in the tuberculous process and were resected. The pleura was apparently not involved. Upon resecting a part

FIG. 1.

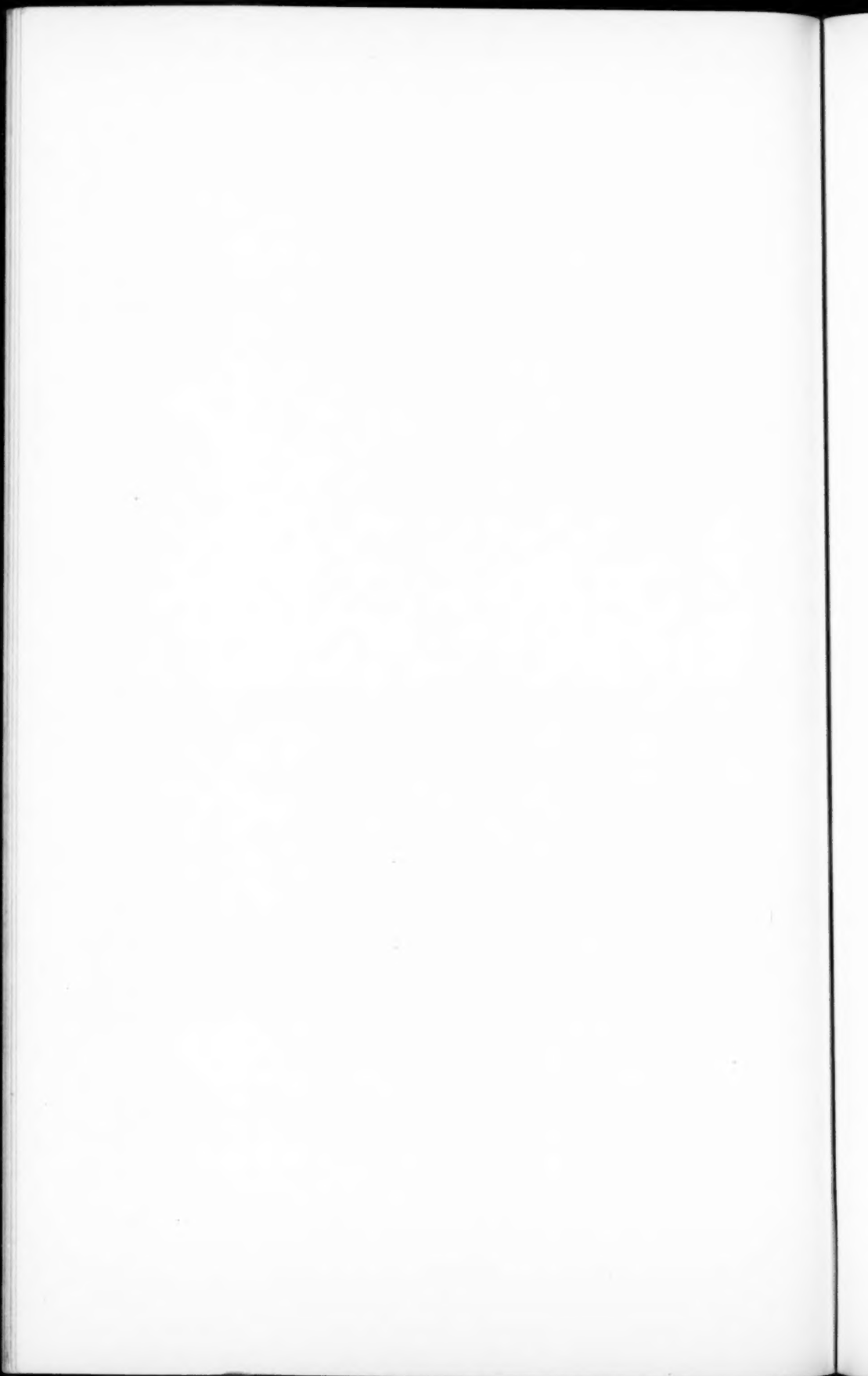


Large umbilical hernia containing almost entire small intestine. Ten hours after birth.

FIG. 2.



Four weeks after operation.



of the muscle it was found that the tuberculous process had worked its way into the posterior portion of the breast. This was resected, and the rest of the breast tissue was then brought together with catgut sutures. The muscular tissues were sutured over the defect in the ribs and cartilage.

The patient made a practically uneventful recovery, and since the operation, which was done over sixteen months ago, she had had no further trouble. There was no resulting deformity of the breast.

HAIRPIN IN MALE BLADDER REMOVED BY THE AID OF A CYSTOSCOPE.

DR. HOWARD LILIENTHAL presented a man, 55 years old, who had taken one of his wife's hairpins and inserted it into his urethra for the purpose of relieving an irritation of the canal. The pin accidentally got beyond his reach and disappeared in the urethra. He consulted his physician, Dr. Cereseto, who was able to introduce a catheter into the bladder, and when Dr. Lilienthal saw the patient, about 24 hours later, a full-sized sound could enter the bladder without any difficulty. It was thereupon concluded that the hairpin had passed into the bladder, and cystoscopy was proposed.

With the aid of the cystoscope, the hairpin was immediately located. The forceps that was devised by Dr. Follen Cabot for the removal of small foreign bodies from the bladder was then introduced through the cystoscope, and with it the pin was seized at a point about half way between an extremity and the bend. Fortunately, it was made of very thin, corrugated wire, and no difficulty was experienced in drawing it into the cystoscope and extracting it. The entire procedure occupied but a very few minutes. There was no reaction whatever and the patient is well.

INTESTINAL OBSTRUCTION FOLLOWING OPERATION FOR APPENDICITIS.

DR. LILIENTHAL presented a young man who, after several attacks of appendicitis of moderate severity, was operated on in July, 1909, and the appendix removed. In his last attack a mass was felt far to the outer side, close to Poupart's ligament. Instead of making the usual transrectus incision, Dr. Lilienthal said he made his incision directly over the mass, and in removing

the appendix through that opening it was necessary to open the general peritoneal cavity. The wound was closed, with drainage, and an uneventful convalescence was expected.

On the day following the operation the patient complained of cramps, which persisted. Flatus was passed, but there was no satisfactory movement of the bowels. On account of these symptoms, but largely because of the patient's suggestive *facies*, the abdomen was reopened on the fourth day through a trans-rectus incision which revealed an enormous coil of obstructed ileum, one leg of which had prolapsed into the abscess cavity, producing complete obstruction. A large amount of gas and liquid *fæces* was evacuated, and the patient made a good recovery without the necessity of resorting to an enterostomy.

In connection with this case, Dr. Lilienthal showed an instrument which he had used to great advantage in this and similar cases. By means of this instrument the over-distended gut could be punctured and its contents evacuated in an absolutely clean and effective manner.

The speaker also emphasized his belief that in cases where there was any doubt as to the permeability of the bowel after an operation for appendicitis, especially in the presence of abscess, a secondary exploratory operation should be done sooner than was now usually the case. In a second similar case that recently came under his observation the abdomen was reopened and an almost identical condition was found, excepting that the entire small intestine was tremendously distended, and an obstruction was traced to a kink at the site of the abscess cavity.

RUPTURE OF A POLYCYSTIC KIDNEY.

DR. ALEXANDER B. JOHNSON presented a man, 34 years old, who entered Dr. Johnson's service in the New York Hospital on May 16, 1909, with the following history:

He had enjoyed throughout his life reasonably good health, and had never suffered from any symptoms referable to his genito-urinary tract. During the past few years he had had from time to time attacks of pain referred to the epigastrium, for which he had consulted several physicians, who had made a diagnosis of gastric dyspepsia of indeterminate causation. The attacks were not very severe and were never referred to the region of the kidney.

On Saturday evening, the day before admission to the hospital, while about to descend the stairs of an elevated railroad station in Brooklyn, he caught his heel in the rubber matting and pitched headlong down a flight of stairs. He was rendered unconscious by the fall, was picked up by a patrol wagon and taken to the police station. He regained consciousness a few moments after he was hurt, and felt well enough in a short time to proceed to his home in the city of New York. He received several contusions of the face and scalp, but no other injuries of which he was conscious except that he suffered a moderate amount of pain in the left loin. He went to bed and slept fairly well. The next morning he observed that his urine was bloody, and at about the hour of three in the afternoon he came to the hospital in a cab. Dr. Johnson saw him about an hour later.

The patient was a fairly well-nourished individual, rather slender than stout. He said that for some time he had had a chronic cough. There were no external evidences of injury except the contusions of the face and scalp, and a small abrasion in the midaxillary line opposite to the seventh rib upon the left side. Urine passed after he entered the hospital was of a deep port-wine color. The heart and lungs appeared to be normal. His temperature was not elevated; his pulse was 90. He complained of a sense of distention and soreness in the left side of the abdomen and loin, just below the ribs.

Physical examination showed that the left loin was occupied by a considerable tumor mass extending downward to the level of the umbilicus, and within two inches of the median line in front. The mass extended upward beneath the ribs. It was flat on percussion, and the colon, displaced somewhat toward the inner side, lay in front of it and produced an area of tympanitic resonance. The left side of the abdomen over the tumor was markedly rigid and quite tender. The patient looked rather pale and anæmic and a diagnosis was made of a rupture of the left kidney, with a large perirenal retroperitoneal hæmatoma.

The patient's condition being good, Dr. Johnson did not operate until the following morning. Under gas and ether an incision was made parallel to the ribs upon the left side, beginning at the outer border of the rectus in front, two inches

below the costal margin and extending backward and outward slightly convex downward to the outer border of the erector spinæ muscle. Upon opening the loose perirenal fat, a hæmatoma of moderate size was entered; but further explorations showed the presence of a large polycystic kidney, which was ruptured horizontally at the junction of the upper with the middle thirds of the tumor.

Upon palpation of the opposite kidney through the wound, it appeared to be of normal size and consistence. The kidney upon the left was removed without difficulty and with trifling hemorrhage. The ureter appeared normal, and the renal artery and vein were of about normal size. The wound was sutured, with a suitable gauze drain left at its posterior angle. The patient did not suffer from shock, and continued to pass abundant urine. The wound healed *per primam*, except for the drainage opening.

Upon the third day after the operation the patient passed 72 ounces of urine, and three weeks after the operation he was passing from 40 to 50 ounces a day. It was of a specific gravity of 1012, and contained a perceptible trace of albumin, together with granular and hyaline casts. The patient had a moderate cough, with very little expectoration, in which no tubercle bacilli had been found. The probabilities seemed to be that he would survive, but whether or not his remaining kidney would continue to functionate, whether he would die eventually of nephritis, or, on the other hand, whether the organ would undergo a similar cystic change, it was at the time impossible to say. The interesting features of the case were that the tumor had never produced any definite symptoms, and that it should only have been discovered after its accidental rupture, the latter accident being, so far as the speaker was aware, unique.

At present, five months after the operation, the patient is in fair health. His urine is of a specific gravity of 1015 and abundant in quantity. A trace of albumin is present. He has resumed his occupation, that of a clerk.

DR. ELLSWORTH ELIOT, JR., said the prognosis of these cases, so far as changes in the remaining kidney was concerned, was rather unfavorable. Two or three years ago a German writer tabulated a series of 75 or 100 cases, which were gathered from

different sources, and in these cases, even where the second kidney was normal at the time of the primary operation, the development of a similar condition in that kidney was apparently hastened.

DR. JOHNSON said he could recall only one other case of unilateral polycystic kidney, which was observed for about four years. The opposite kidney, which in the meantime had shown fairly well marked signs of nephritis, then became greatly enlarged; the patient became uræmic and died without a second operation having been done.

DR. JOSEPH A. BLAKE said it had been claimed that by draining some of these cysts we could relieve the pressure on the parenchyma. In one case of double polycystic kidney he simply punctured some of the cysts. This procedure gave no immediate bad results, but the patient died in a few weeks of renal insufficiency.

THE TWO-STAGE PRINCIPLE IN OPERATIVE SURGERY.

DR. HOWARD LILIENTHAL read a paper with the above title for which see page 30.

DR. CHARLES N. DOWD thought that prostatectomy certainly offered a field for the two-stage operation. Many of the cases which he saw were in very old men who had been allowed to go on until there was complete obstruction. Under those conditions it is certainly a very difficult problem to get them through alive, and their chances are greatly improved by first making an opening into the bladder and completing the prostatectomy at a later date.

DR. ALGERNON T. BRISTOW said that while he was inclined to agree with some of the statements of the author, he would not favor a two-stage operation in dealing with a pus kidney unless the patient was manifestly in an extremely bad condition from sepsis. Personally, he had never done an operation on a pus kidney in two stages, having always been able to complete the operation at one sitting and having regarded it as a source of congratulation that he had entirely disposed of the focus of infection. Up to the present time, he had had no reason to regret his course in dealing with this class of cases. The com-

plete removal of the kidney at a single sitting obviated the necessity of giving an anæsthetic twice, and he thought that a kidney that could be removed at the second operation in five minutes—as Dr. Lilienthal had mentioned in the report of one of his cases—could also have been removed at the primary operation without unduly lengthening the time of the procedure.

In regard to operations on the bladder, where the patient was suffering from long-continued cystitis, there he regarded preliminary drainage as extremely useful, because it diminished the chances of infection.

DR. ALEXANDER B. JOHNSON, discussing the treatment of suppurating kidney, said he did not agree entirely with Dr. Lilienthal that such a kidney should be treated, as a rule, by a primary nephrotomy and a secondary nephrectomy at some later period. In a moderate number of cases—not so much those that we ordinarily recognize as pyonephrosis—but cases of infected hydronephrosis with a very large sac, primary drainage of the sac and a subsequent nephrectomy after the sac has had time to diminish in size, was sometimes of advantage; but this did not apply to the ordinary type of acute or chronic suppuration of the kidney. Dr. Johnson said it had been his experience, in dealing with pyogenic infections of the kidney, whether the infection be hæmatogenous or secondary, due to tuberculosis or renal calculus, that such a kidney, after incision, if not already seriously infected with pyogenic germs, would soon become so, and that its removal at a secondary operation was more difficult than it would have been at the time of the primary operation. He could recall a number of instances, however, in which he felt obliged to do first a nephrotomy and later a nephrectomy, but those were cases where the kidney was not only the seat of a primary or secondary pyogenic or mixed infection, but in which there was also a large perirenal abscess. In some of those cases he had felt that the risks of a nephrectomy were too great to be undertaken as a primary operation. He had not followed this procedure as a matter of choice, but because he felt that there was nothing else to do, and the removal of the kidney at a later period had often proven a very difficult operation.

In cases of uronephrosis or hydronephrosis which could not be treated by conservative means, even where the tumor was of large size, he would look upon a primary nephrectomy as

preferable to a primary nephrotomy and drainage, because in spite of the utmost care they were apt to become more or less septic before the second operation was done.

DR. LILIENTHAL, in closing, said that during the past two and a half years he had done at least sixteen cases of prostatectomy in two stages, and all of those cases had recovered. Many of these patients were of advanced age, and some of them were extremely feeble, with cardiac and other lesions. This method had also been practised with success by Drs. Goldenberg, Cabot and Ware.

Dr. Lilienthal said that Dr. Johnson had evidently misunderstood him in regard to his method of treating pus kidneys. In his paper he had made no reference to hydronephrosis, and he would not treat such a condition of the kidney in two stages without a particular reason. The method he had advocated related to the treatment of pus kidney. First, an incision should be made into the kidney; then, when the patient had recovered from the effects of that incision, in four or five days, certainly less than ten days, before dense adhesions had formed, it would be found that the kidney had shrunk away from its bed, and could be removed in less than one-quarter of the time it would have taken at the primary operation. It was not a secondary nephrectomy that he was urging, but a *two-stage* nephrectomy, which was quite a different thing. There was practically no mortality when the operation was done by this method.

Stated Meeting, October 27, 1909.

The Vice-President, DR. ELLSWORTH ELIOT, JR., in the Chair.

EPIDIDYMECTOMY FOR TUBERCULOSIS.

DR. FRANK S. MATHEWS presented a man 39 years old who gave a history of having had tuberculous glands removed from both sides of his neck by Dr. Murphy of Chicago, 13 years ago. About five years ago he suffered from frequent urination and pain for a few months. These symptoms then disappeared, but a year before operation he developed a swelling on the left side of the scrotum. He consulted a physician, who regarded it as

a hydrocele and aspirated it several times. It always recurred, however, and subsequently a similar swelling developed on the opposite side.

When Dr. Mathews first saw the patient, two and a half years ago, both sides of the scrotum were occupied by a tumor about double the size of an adult fist. There were no evidences of tuberculosis elsewhere in the body. The patient's temperature, during the twenty-four hours, ranged from normal to 101. The case was regarded as one of tuberculous epididymitis, and a double epididymectomy was done. Through incisions on the outer sides of the scrotum the epididymis and vas of either side were removed without injuring the spermatic vessels. The operation, which proved somewhat difficult, occupied an hour and a half. There was fluid in both tunica. Both wounds were closed with the exception of an opening for a small piece of rubber tissue. Both testes were hard at the time of the operation, but gradually became normal to the feel. The patient has gained about 20 pounds since the operation, and is now enjoying excellent health. There is nothing abnormal in his urine at present. His sexual power, which was in abeyance at time of operation, has returned to the extent that he has sexual desire and orgasm but no emission. The prostate feels slightly nodular. His wife became pregnant between the times of involvement of the left and right testicle.

SARCOMA OF THE INTESTINES AND STOMACH.

DR. JOHN F. ERDMANN presented a man 57 years old who came under his care in June, 1909, with the history that about one year ago he began belching and vomiting bile, and had attacks of pain encircling his abdomen, particularly marked in the lateral regions. These pains would subside on expelling flatus. Three months before coming under observation he had acute pains in the pit of the stomach, and vomited some food, but the vomitus contained no retention evidences. He had lost considerable weight during the preceding six months. He was constipated. He had never vomited blood. Lately, he had had some food intake pains. He complained of a painful tumor in the lower abdomen, which he said was fixed.

Upon examination, a tumor the size of a cocoanut was found fixed to the abdominal wall between the umbilicus and the pubis.

There was a certain amount of mobility, deep-seated, as though the tumor was pedunculated. Palpation was extremely painful. By rectum, the patient was very sensitive, the examining finger just reaching the mass.

On June 5, 1909, upon exposure, a tumor was found invading the jejunum and ileum, firmly adherent to the parietal peritoneum in the median line. This was released without any difficulty by excising the peritoneal invasion. The tumor was found to consist of large sections of jejunum and ileum. The coils were doubled upon themselves, with a large central coil invaded by the tumor occupying the lumen and walls of the gut. At the proximal end, well up in the jejunum, two other masses were found invading the lumen to such a degree as to produce stenosis. The balance of the intestines, both proximal and distal, were found negative.

Forty-eight inches of jejunum and ileum were excised, and a side-to-side anastomosis made by means of the Roosevelt clamp. Previous to completing the peritoneal toilet, a complete examination of the abdominal contents was made, and upon palpating the stomach a mass about the diameter of a silver dollar was found in its greater curvature. No other metastases presenting, this was excised, the opening sutured and the abdomen closed.

After a rather stormy postoperative convalescence in the first week, the subsequent period was uneventful. Six weeks after the operation the patient weighed 129 pounds. His present weight was 157 pounds, a gain of thirty pounds in three months.

Pathologically, the growth was reported as a small round-celled sarcoma.

OPEN ULCER OF STOMACH CLOSED BY ADHERENT GALL-BLADDER: GASTRO-ENTEROSTOMY.

DR. WILLIAM A. DOWNES presented a man of 42 who gave a history of stomach trouble extending back for many years. In July, 1908, this condition began to be accompanied by pain and periodical vomiting—about twice weekly. The following December the vomiting became almost continuous and the pain more severe. He was unable to retain scarcely any food and his weight fell from 150 to 115 pounds. His condition was such that he was practically bed-ridden.

At the time of the operation, on April 12, 1909, a small

tumor could be felt in the epigastric region, just in the median line. Upon opening the abdomen and exposing the pyloric end of the stomach by raising the liver, an ulcer of the stomach about the size of a silver 25-cent piece presented. This was an open ulcer, with its edges firmly agglutinated to the overlying gall-bladder, and this had prevented any escape of the gastric contents. Actual peritoneal adhesions between the gall-bladder and stomach existed only along the posterior margin of the ulcer. There was extensive induration involving the entire pylorus and the mass was firmly fixed posteriorly—in fact the condition was thought most likely to be malignant, but the extent and location made any attempt at removal out of the question.

As the patient was in very poor condition, the opening in the stomach was sealed by replacing the gall-bladder over it, suturing it with catgut, and covering it with omentum. A posterior gastro-enterostomy was then done.

The patient made a rapid recovery, and had had no gastric pain or vomiting since the operation. He had gained about 30 pounds in weight.

In reply to a question as to why he had not closed the opening in the stomach in the usual way, and had used the gall-bladder instead, Dr. Downes said that aside from the patient's poor condition, the depth of the ulcer was such that it was almost impossible to get at it. No attempt was made to remove the mass which involved the pylorus, as it would have occasioned too much shock. The condition at the time was regarded as unquestionably malignant, and it was thought that the quickest and most expedient way to meet the requirements was to take advantage of the position of the gall-bladder.

In view of the subsequent history of the case, and the marked improvement in the man's condition, the mass which was seen at the time and which had since disappeared, was probably composed of inflammatory exudate.

DR. ELLSWORTH ELIOT, JR., said the method described by Dr. Downes had been utilized by an English surgeon, who had used the gall-bladder successfully in one or two instances in sealing a gastric perforation. The danger of a possible twist in the gall-bladder in manipulating it for this purpose should not be lost sight of.

Dr. Eliot said that in case of gastro-enterostomy for supposed

pyloric cancer upon which he operated about nine years ago, the anastomosis was completed by means of a Murphy button. The operation disclosed a hard circumferential nodular growth in the pylorus that appeared unquestionably to be carcinoma. Three months after the anastomosis, when the abdomen was again opened to radically excise the growth, the tumor had completely disappeared. It was doubtless inflammatory in nature.

For seven or eight years after these operations, the patient complained of intermittent attacks of abdominal pain. At the end of that time the Murphy button was passed per rectum and her attacks of pain were relieved.

INTESTINAL ANASTOMOSIS BY INVAGINATION:
UNION OF COLON WITH RECTUM.

DR. WALTON MARTIN presented a girl who had been operated on by Dr. Chas. L. Gibson for the removal of an intraligamentous cyst, with adhesions. In the course of its removal, the sigmoid was denuded, necessitating the resection of a portion of it. An anastomosis was then done by invaginating the lower end of the colon into the upper end of the rectum, and inserting a row of catgut sutures. A subsequent examination with the sigmoidoscope failed to show any constriction in the lumen of the bowel.

NEPHRECTOMY FOR HYDRONEPHROSIS.

DR. ALEXANDER B. JOHNSON present a man 41 years old, a driver by occupation, who was admitted to the New York Hospital on June 26, 1909. The history obtained from him was that a tumor was first noticed in the right hypochondrium seven years ago. It had slowly but steadily increased in size and recently had become painful. The pain was referred to the loin, radiating downward and inward to the groin. The urine was clear, amber in color, acid, with a specific gravity of 1031; it contained calcium oxalate crystals, but neither albumin nor sugar.

The man was operated on by Dr. F. W. Murray on July 3, 1909. Through a right rectus incision, six inches long, a very large hydronephrotic kidney was exposed. On account of its great size, its removal was deemed impracticable, and the sac was thereupon incised anteriorly, giving vent to two quarts or more of a reddish-brown fluid. After the insertion of a drainage tube, the wound was closed. The tube continued to give exit

to urinous fluid in large amounts. After a time, ammoniacal infection and decomposition of the urine occurred, and the escaping urine became distinctly purulent. The cavity of the sac was irrigated with various antiseptic solutions in the hope of clearing it, but without much success.

On August 23, 1909, Dr. Johnson excised the sinus and a portion of the former scar, and through an eight-inch incision made below and parallel with the costal border he exposed a large hydronephrotic kidney. It was moderately adherent, and required somewhat prolonged dissection with the hand and fingers before it could be enucleated. The pedicle was clamped and tied *en masse* with ligatures of strong plain gut, and the wound closed by suture. The patient made an uneventful recovery.

In connection with this case, Dr. Johnson showed the specimen, which consisted of a large, hydronephrotic kidney with dilated pelvis and calices. The sac was quite thick and tough, and the kidney structure had, for the most part, disappeared, so far as could be seen with the naked eye. The cyst-like cavity contained numerous spherical and ovoid calculi, 109 in number.

Dr. Johnson, in reply to a question, said the calculi were scattered about in several of the calices, and some were found in the pelvis. He recalled an almost identical case which was operated on by Dr. McBurney. In that case, the kidney had not been previously opened and drained, and the formation of the stones could not be attributed to ammoniacal infection of the urine, as no infection had occurred. In his own case he did not think the entire kidney was infected; probably only some of the dilated calices.

CARCINOMA OF BLADDER AND UTERUS: HYSTERECTOMY,
CYSTECTOMY, AND DOUBLE LUMBAR
URETEROSTOMY.

DR. WALTON MARTIN presented a negro woman, 43 years old, who was admitted to St. Luke's Hospital on September 3, 1909. Her chief complaints were bleeding from the uterus, and vesical tenesmus. For the previous fifteen months she had had constant bleeding from the vagina, so that she had been unable to determine the menstrual period. The amount of hemorrhage varied from time to time, but was never very profuse. Three months ago the patient began to have bilateral pain in the

lower pelvis, radiating to the back, and vesical tenesmus. There had been no hæmaturia and no increased frequency of urination. She had lost about 25 pounds in weight in the last year.

The previous history obtained from the patient was that she had had eight full-term children and one miscarriage. Menstruation began at fourteen and lasted usually four days. Before the onset of her present illness she had always been in good health. Her family history was negative.

On vaginal examination, the cervix of the uterus was found to be enlarged and hard, and there was an irregular ulcer extending from the cervix to the anterior vaginal wall. Between the cervix and the bladder there was a firm mass apparently involving the bladder wall. Abdominal examination was negative. The woman was poorly nourished and looked ill. Temperature, 100; pulse, 100; respirations, 26. The urine was acid, with a faint trace of albumin. The microscope showed a few red blood cells and leucocytes. The clinical diagnosis was carcinoma of the uterus. On September 6, 1909, under ether anæsthesia, with the patient in the lithotomy position, the ulcerated area on the cervix was cauterized, and an incision made through the anterior vaginal wall, about one-quarter of an inch below the ulcerated surface. An attempt was made to dissect the vaginal wall with the growth away from the bladder, but it was soon seen that the indurated tissue extended into the wall of the bladder in this situation. The vagina was accordingly packed with gauze, and the patient placed in the Trendelenburg position. The abdomen was opened in the midline from one inch above the navel to the symphysis pubis. The body of the uterus, the tubes and the ovaries appeared normal. The cervical portion was enlarged and indurated, and this induration extended into the base of the bladder and the tissue about the right ureter. No enlarged lymph-glands were observed.

The ovarian arteries and the round ligaments were ligated and divided on each side. The uterine arteries were ligated close to their origin. The ureters were exposed for about four inches, then divided three inches above their insertion in the bladder, and through one-inch stab-wounds in the lumbar region they were drawn out by artery forceps. About one inch of the ureter was allowed to hang free from the skin of the loin, and a small catheter was inserted into each ureter. The bladder and uterus

were dissected out, the vagina being divided about one inch below the ulcerated surface of the cervix. There was profuse hemorrhage from the vaginal vessels. The vagina was closed with catgut stitches.

On removal of the bladder and uterus it was evident that too much peritoneum had been taken away to make it possible to cover the denuded surfaces. A gauze drain was introduced in the lower angle of the wound, and the abdomen was closed.

After the operation, the patient was in moderate shock for a few hours. The pulse was 100, regular, but weak. On the following day the pulse was of good force, temperature, 102; respirations, 24. On the third day the temperature was normal, the pulse 100.

On the second day, the drainage from the ureters being unsatisfactory, the catheters were removed, the ureter ends split and turned back and sutured into the lumbar wounds. From this time on the right ureter drained normally, drop by drop. The skin about the orifices of the ureters was kept scrupulously clean, and the urine allowed to escape into sterilized gauze pads. The patient seemed to be comfortable. The left ureter, however, did not drain properly, only a few drops of urine escaping from time to time.

On the eighth day the skin stitches were removed from the abdominal wound, which had healed by primary union except for the drainage tract. This was closed at the end of the second week. On the eighth day a ureteral catheter was passed into the pelvis of the left kidney. The urine escaped drop by drop. On the following day the patient had a chill, and the temperature rose from normal to 104. Two days later the left ureter was washed out with normal salt solution. After that there was no further interference with the ureters. For about ten days there was an afternoon rise of temperature; then it gradually fell to normal. The patient gained strength and flesh, and left the hospital 35 days after admission in good condition. She returned to her home, and now did her usual housework—washing, ironing, and cooking. She wore about her loins a sterilized gauze pad, which she herself changed every four hours.

Histological examinations made from sections taken from the cervix and wall of the bladder showed carcinoma of those organs.

HYDRONEPHROSIS, CONGENITAL, RELIEVED BY
NEPHRECTOMY.

DR. SAMUEL ALEXANDER presented a man, 22 years old, who was operated on in Christ Hospital, Jersey City, in June, 1908, for the relief of intermittent attacks of pain in the right hypochondrium, associated with enlargement of the kidney on that side. At that time, two incisions were made, one abdominal, apparently for exploratory purposes, and another in the right lumbar region, through which the kidney was opened and drained. The patient made a good recovery from this operation, and went home. Ten days later he had a sudden elevation of temperature. The lumbar wound re-opened, and there was a profuse secondary hemorrhage. A tube was inserted into the kidney, and this tube was worn continuously for eighteen months. The tube was attached to a rubber glove which was worn next to the patient's body, and into this about 16 ounces of urine was excreted daily. The urine was of a very low specific gravity and contained but a trace of urea. The opposite kidney secreted about 30 ounces of normal urine daily through the urethra.

When Dr. Alexander first saw this patient at Bellevue Hospital on February 1, 1909, his condition had become so uncomfortable from the long-continued drainage of the urine through the loin that an operation for his relief was deemed imperative. The right kidney was exposed through a lateral incision, and it was found to be in a condition of apparently congenital hydronephrosis, which was probably the result of its anomalous blood supply, the renal vein and artery overlapping and compressing the ureter, causing at times complete occlusion of the latter. The kidney was made up of three or four large cysts, containing cloudy fluid. An intracapsular enucleation of the organ was done, and the patient made a good recovery.

Dr. Alexander said that the chief reason for showing this case was to bring up for discussion the question of the post-operative treatment of these patients, as well as cases of inoperable tumor of the bladder, where double nephrostomy was imperative. In the case he had shown, the patient was rendered uncomfortable for many months by wearing a drainage tube which made it impossible for him to rest on his back.

By doing a ureterostomy, as in the case shown by Dr. Martin,

we certainly increased the comfort of those patients with inoperable cases of tumor of the bladder. In such cases he was in favor of doing the operation in two stages,—first doing a double ureterostomy and subsequently extirpating the bladder. The postoperative treatment of these patients was of the utmost importance to the patient's comfort.

DR. CLARENCE A. MCWILLIAMS said he had seen the late Dr. McCosh perform three such operations on the uterus and bladder where the ureters were cut and allowed to remain *in situ* in the pelvis. The urine was passed per vagina—the patients wearing rubber urinals. One of these patients was alive a year after the operation, the second died of recurrence within a few months, while the third was lost sight of subsequently.

DR. ERDMANN said he had seen paroxysmal anuria occur after unilateral ureterostomy. In that case it was demonstrated that there was no blocking of the opposite ureter, and the temporary anuria was apparently due to irritation of the ureter.

DR. MARTIN, in closing the discussion, said he preferred to do an implantation of the ureters in the loins rather than to let them dangle free in the laparotomy wound; he regarded the former as a cleaner and safer procedure. In reviewing the literature of the subject he had found the report of one case of exstrophy of the bladder where a double ureterostomy had been done with loin implantation by Dr. John T. Bottomley and the patient was alive and fairly comfortable fifteen months after the operation. In another case done for carcinoma of the bladder, reported by Rovsing, the patient wore a rubber apparatus which kept her dry and comfortable, and she was in good condition one year after the operation. In his own case, Dr. Martin said, the patient kept herself fairly comfortable by the use of layers of gauze. He regarded the two-stage operation of distinct advantage in dealing with inoperable tumors of the bladder. In reply to a question, he said that he had feared that the ureter would become kinked in the course of his implantation, but the introduction of a catheter had shown that none had occurred.

AN OPERATION FOR PARALYTIC SHOULDER JOINT DUE TO INFANTILE PARALYSIS.

A paper with the above title by Dr. O. Kiliani, was presented and, in the absence of the author, was read by the secretary, for which see page 79.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Meeting, held October 4, 1909.

DR. WILLIAM J. TAYLOR, President, in the Chair.

STRANGULATED INGUINAL HERNIA IN A TWO-WEEKS' OLD INFANT.

DR. JOHN H. JOPSON reported the case of a two-weeks' old infant seen by him June 24, 1909, with a history indicating that a hernia had been down about 24 hours. Under taxis, reduction seemed to be effected, and a wool truss was applied. On the following morning the infant was brought to the Presbyterian Hospital with the hernia again protruding and fecal vomiting. Under chloroform, herniotomy was done. The edges of the sac were sutured with the edges of the canal and the external ring, a typical Bassini operation not being possible. Uncomplicated recovery. Dr. Jopson remarked that the strangulation of a hernia while not a very common accident in children, was proportionately more common in early infancy than in older children. It has been his experience that an operation is less frequently required to reduce a strangulation in infancy than is the case with adults. Hence taxis should always be given a trial in cases seen early, unless there is some distinct contra-indication. With regard to the frequency with which operation is required, it would seem that there has been a tendency to underestimate rather than to overestimate the number of cases that have called for operations. Coley quotes the statistics of Estor in this connection. Estor was able to collect 225 cases of strangulated hernia in children under two years of age, but found that in nine of the largest of the largest clinics of Europe the records showed not a single case. At the Hospital for Ruptured and Crippled only 17 had been operated upon in children, and of these 12 were under two years of age. Telford, as quoted by Ashhurst, collected 224 cases

under four years that had been operated, and of these 112 were infants under six months, and 13 were given by Ashhurst as one month old. Fifteen cases were added by Ashhurst, the youngest 14 days, and the oldest 14 months. Dowd analyzed 125 cases under one year. It will thus be seen that the number of cases available for study is quite respectable. Mortality has been quite low. While Estor's tables show a mortality of 23 per cent., much the same as in adults, both Coley and Dowd agree that this should be lower, the latter stating that it should not exceed 10 per cent. when the operation is done promptly. The case here reported is seen to be among the youngest, although operation has been done for strangulated umbilical hernia as early as the second day. Dr. Jopson had seen two other cases in very young children, one aged one month being under Dr. Wharton's care, and the other, aged two months, was seen with Dr. Hodge. The latter case was a case of strangulation of the ovary, which puts it in a class by itself, as the gut was not involved. All of these cases recovered.

DR. ASTLEY P. C. ASHHURST said that during the last year he had seen three children, one of six weeks, one of eleven months, and one of three years, in which he had diagnosed strangulated hernia and on whom he had operated with recovery. A fourth child, but four months of age, was then seen, with a history of the sudden appearance of a lump in the right groin, pain, vomiting, obstipation, and fever. Taxis had been tried but the lump could not be reduced. He thought this also to be a strangulated hernia, but on operation found a hydrocele of the cord!

DR. J. B. CARNETT said that the youngest patient he could recall ever having seen with incarcerated or strangulated hernia was a child about four years of age. For several days before admission to the University Hospital the child had abdominal pain, rigidity, fever, frequent passage of stools composed of mucus and associated with severe rectal tenesmus. On examination just prior to operation the child exhibited symptoms of extensive peritonitis. Tenderness was noted over the entire abdomen but was most pronounced over a right inguinal hernia which did not give any impulse on crying and which very gentle taxis failed to reduce. Under ether the hernia slipped back spontaneously. On opening the abdomen through a median

incision there was found a wide-spread peritonitis due to a perforated appendix which was adherent by its tip to the rectum.

The hernia in this patient was not seriously considered as the primary cause of the patient's trouble. The child had been seen outside of the hospital by several competent physicians who could not have failed to observe the very obvious hernia had it been present from the onset of the illness. It therefore seems probable that the hernia in this patient was forced out sufficiently to become incarcerated by the abdominal straining incident to severe rectal tenesmus.

The case belongs to a type of hernia which may easily lead to an error in treatment, viz., that class of cases in which a very evident strangulated or incarcerated hernia might account for all the symptoms presented at the time of examination but in which careful questioning will elicit the fact that the hernia developed secondary to some other cause for abdominal straining. Operative treatment may be necessary for relief of the hernia but is often more urgently imperative for the primary abdominal condition, the symptoms of which have been masked by the strangulated or incarcerated hernia. In the absence of an exact history the underlying primary condition may readily be overlooked and may be the cause of a lethal termination despite a skilfully performed operation for hernia.

ILEUS DUE TO GALL-STONE.

DR. CHARLES F. MITCHELL exhibited a gall-stone removed at the Pennsylvania Hospital, in the service of Dr. Hutchinson, from a woman, aged 61, who gave a history of having been sick ten days, the only symptoms being vomiting. On admission she had a normal temperature; pulse 120, very weak and compressible. The vomitus was fecal in character. This had been going on for some hours. She had no abdominal distention or tenderness, and no rigidity, the only symptom being the fecal vomiting. She said she had a distressed feeling in the abdomen. The abdomen was opened by an incision in the upper right rectus; the peritoneum was found perfectly normal; she had very fat abdominal walls, about four inches in thickness and took ether very badly. The hand introduced into the abdominal cavity immediately came down on a mass in the small bowel high up either in the upper part of the ileum

or in the jejunum, and this mass proved to be a gall-stone. A small incision was made in the bowel wall, over the stone, through which the stone was removed, but the patient died a few hours later.

DR. JOHN H. GIBBON said that last spring he operated upon a case presenting symptoms quite similar to those of Dr. Mitchell's case. The patient was an old lady 68 years of age, in whose case, three months previously, he had diagnosed gall-stones and advised operation. She was taken rather suddenly ill with severe abdominal pain, persistent vomiting, and marked exhaustion. Dr. Stengel saw her on the day of operation with her physician, Dr. Mary Griscom, and thought that in addition to the gall-stone condition she probably had an acute pancreatitis. When seen by Dr. Gibbon she was very much exhausted, but her circulation was good and there was a very little rigidity and tenderness in the upper right quadrant; the rest of the abdomen was soft. The tenderness was not as marked in the gall-bladder region as it had been during the three months previous. On opening the abdomen through the upper right rectus the gall-bladder was found densely adherent to the duodenum. On separating the structures a large hole was found in the duodenum and a corresponding one in the gall-bladder. There was considerable induration around the openings; and on closing it was found that the duodenum was practically obstructed, so that a gastro-enterostomy was done. The patient continued to vomit considerably during the next twenty-four hours but gradually improved in spite of an infection of the wound. On the sixth day she passed two gall-stones, one of enormous size, quite as large as the one shown by Dr. Mitchell. The patient made a good recovery and is well to-day.

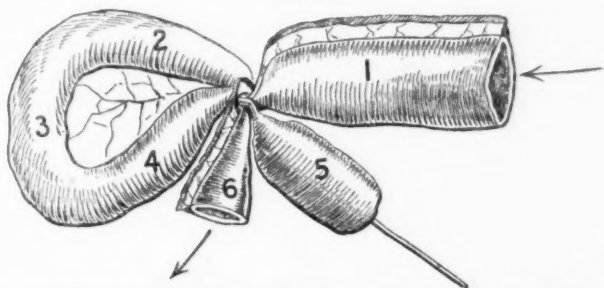
Persistent vomiting, with a flat and soft abdomen, is indicative of some obstruction high up in the intestinal tract.

INTRAPERITONEAL HERNIA OF ILEUM THROUGH RENT IN MESENTERY.—ADHERENT MECKEL'S DIVERTICULUM.

DR. A. P. C. ASHHURST reported the history of a boy of 12 years who had never been sick, who fell and hurt his hip. On the following day he ate two large bunches of grapes, a quantity of chocolate cake, and soon afterward developed pains in his stomach, then vomited. For three days symptoms of obstruction

of the bowels continued unrelieved by medical treatment. He was then admitted to the Episcopal Hospital in the service of Dr. Frazier, to whom Dr. Ashhurst was indebted for the privilege of operating. On admission the patient had a temperature of 103° , the abdomen was distended, he was vomiting fæces and passing blood and mucus from the bowel. When this child was examined, the umbilicus did not look normal,—it seemed large and thin, suggesting the possibility of the presence of a Meckel's diverticulum. An incision was made in the middle line below the umbilicus. On opening the abdomen the omentum was adherent. On freeing the omentum there was a gush of fecal smelling bloody

FIG. 1.



Volvulus of loop of ileum strangulated in opening in mesentery, complicated by Meckel's diverticulum. The arrows show the normal fecal current. The loop of ileum (2, 3, 4) has passed through an opening in mesentery until arrested by drag on Meckel's diverticulum (5), which springs from ileum at junction of 4 with 6, and which is attached, through fibrous cord running from its tip, to anterior abdominal wall in left hypogastric region.

fluid, after the escape of which a black coil of gut was seen lying in the pelvis. This was pulled up, and seemed like a volvulus; on turning it up there appeared on the under side a Meckel's diverticulum about as thick as two fingers, not quite as long. Something snapped, and the diverticulum with a long cord attached to its tip came out of the wound. The gut was then carefully packed off and examined. There seemed to be some constriction preventing reduction of the volvulus, and as the entire loop was gangrenous and the constriction could not be relieved, it was decided to take the whole thing out. When the clamps were applied for resection the gangrenous bowel burst, but the discharge occurred only on the gauze packs. The affected portion of intestine, from 14 to 18 inches, was resected, and an end-to-end anastomosis was done; the pelvis was drained by a glass tube, and the operation hastily completed (time 40 minutes)

as the child was in very bad shape. Death occurred three hours later.

It took a long time to determine what the specimen was. Finally the conclusion was reached, after careful study, that there had been a hole in the mesentery and through that the ileum had gone from the upper surface of the mesentery downward as far as it could until it was caught by the base of Meckel's diverticulum. As the diverticulum was attached to the abdominal wall it could not get through; the loop which had passed through the rent then became twisted on itself and gangrene followed.

SUBCUTANEOUS CERVICAL HÆMANGEIOMA.

DR. JOHN B. CARNETT read a paper with the above title, for which see page 65.

OVARIAN CYST WITH TWISTED PEDICLE.

DR. GEORGE G. ROSS reported the history of a woman aged 35 years who for eight years had been aware of the presence of a palpable tumor—an ovarian cyst, for which she had refused operation. Three days before admission to hospital she had been treated by an electrotherapist; following this treatment she was attacked with violent abdominal pains, nausea and vomiting, for which condition she was brought to the hospital. Upon opening the abdomen a large quantity of free chocolate colored material escaped, and a cyst, the size of a man's head, springing from the right ovary, was exposed. The cyst was gangrenous, twisted about its pedicle, and a rupture in its wall of about $2\frac{1}{2}$ inches in diameter was revealed. The cyst was densely adherent to adjacent structures. Its removal was successfully accomplished, but patient developed general peritonitis with double bronchial pneumonia, resulting in death after 36 hours.

OVARIAN CYST WITH TWISTED PEDICLE; CHRONIC APPENDICITIS.

DR. ROSS reported the case of a girl aged 12 years, who was brought to the hospital on the sixth day after the onset of pain in the right iliac region, she had also a palpable mass in the left lower abdomen, extending to the median line. Upon opening the abdomen the mass on the left side proved to be a cyst of the right ovary, twisted on its pedicle two and one-half turns. It was very dark in color and evidently was approaching gangrene.

It was extensively adherent to the surrounding structures. Adhesions were separated and the tumor removed. The appendix was found in a state of chronic inflammation and was likewise removed. The reporter was of the opinion that a twist of a pedicle of an ovarian cyst had been occasioned by the active peristalsis of the bowel produced by an acute exacerbation of chronic appendicitis.

OVARIAN CYST COMPLICATED BY UTERINE MYOMA
UNDERGOING MALIGNANT CHANGE.

Dr. Ross reported the history of a woman, 45 years of age, who for five years had been aware of the presence of a tumor within her abdomen. Recently the tumor had increased rapidly in size. Upon admission her appearance was very striking, with drawn face, emaciated arms and chest and greatly swollen abdomen; circumference in largest part 54 inches. The weight of patient with tumor was 217 pounds. An abdominal incision exposed a multilocular cyst which was removed, bringing to view multiple myomatous tumors of the uterus, the largest one the size of a man's head, which were removed by partial hysterectomy. The operative shock was controlled by saline infusion. Subsequent uneventful recovery. After the removal of the tumors the patient weighed 115 pounds, making 102 pounds as the approximate weight of the tumors. Among the myomatous masses removed was a small nodule of tissue of a cellular constitution with comparative little intercellular substance and no well defined connective tissue aside from a small amount around a few of the larger blood-vessels; the cells making up the growth were ovoid and spindle shaped, to some extent arranged in fasciculi, particularly the spindle-shaped cells, while the ovoid cells were without such definite arrangements. These cells stained well, showing good nuclei and nucleoli; a few mytotic figures were seen.

Dr. WILLIAM J. TAYLOR stated that many years ago he was present when Dr. Keen removed from the abdomen of a girl of 15 a tumor which weighed 118 pounds. The girl weighed 90 pounds after the tumor had been removed. The appearance of the abdominal cavity after the tumor had been removed was most extraordinary, suggesting a disembowelled subject. The girl made a good recovery.

CORRESPONDENCE.

EXAMINATIONS OF HOSPITAL INTERNES.

EDITOR ANNALS OF SURGERY:

The frequency of complaints concerning the general efficiency of the internes in large hospitals is a matter of common knowledge. These complaints, leaving aside all criticisms of a personal nature, concern less the actual amount of information possessed by internes than their readiness to apply such knowledge. In matters of intricate diagnosis and in the domain of the special branches of medicine, familiarity with basic facts and the technical skill necessary to apply them are both essential.

In comparing the examinations now held for the selection of internes with the examinations held some years ago when the complaints now prevailing were rarely if ever heard, one striking difference is to be noted. The examinations as at present conducted cover only the major divisions of medical practice and include few questions—and these of broad and common type; they are distinctly restricted in their scope; and they are generally directed to subjects of such prominence that ignorance of them would be regarded as more or less shameful. Apparently what has happened all over the country is this: Because of the superficial character of the examinations an undesirable group of men have been able to show an excellence which is merely apparent, and higher grade men have generally absented themselves from competition by reason of the fact that they have won posts in the few institutions, regarded as "exclusive," either for the proper reason that their competitive examinations are stricter, or for the improper reason that the positions are secured through personal or family influence.

There can be little doubt, of course, that back of it all the fault may be assigned to the schools from which these internes are graduated. Granted that there are differences in the educational work of schools, it must be clear that as far as formal text-book knowledge of symptomatology, diagnosis and therapeutics of the more common diseases is concerned, these points,

as the higher lights in the general picture, are probably taught with equal insistence in the poorly qualified school and in the better institution. The real differences would be much better brought out either by extending the scope of the examination questions so as to include the special branches of practice and more of the fundamental and technical subjects, or by insisting also upon actual bedside and laboratory practical examinations. The generally accepted high grade of the personnel of our national medical service is doubtless due to the fact that the examinations leading to them embrace all these points, and bring out the candidate's general educational qualifications.

It may be thought that the labor connected with such thorough examination of a large number of candidates would be out of proportion to the value of the results in choice of hospital internes; but without effort little can be attained in any direction. The matter—involving directly human life—is unquestionably of sufficient importance to warrant any effort necessary to better existing conditions. The drift of the best men in college classes to hospitals with high demands, even though these be sometimes institutions with restricted chance for experience, is undeniable. When hospital selection is purely a personal matter, a question of “pull,” of possession of individual or family influence, the institution of course deserves just what it may get.

If, in actual truth, the burden of thorough examination be a matter of serious difficulty the institutions concerned should arrange to take advantage of the results of the State Examining Boards. On its face this may seem impracticable, but in reality the objections are purely apparent and might easily be obviated by adjustments which would vary with different institutions and in different states. It is always easy to obtain from colleges the class records of individual students applying for posts of hospital internship, and the relative standing of schools might be well determined from year to year by the records which the *Journal of the American Medical Association* publishes annually (for last report see *Journ. Am. Med. Assoc.*, May 22, 1909) indicating the proportions of failure of candidates for license from the different schools of the country. Either such data might form the basis of selection alone; or there might be added a brief personal examination of the candidates, preferably of a practical (bedside and laboratory) character.

Careful consideration should, however, be given to the matter of school standing if such a plan be considered.

Many small schools with poor clinical and laboratory facilities are nevertheless able by a high development of the "quiz" system of instruction to prepare their graduates in an exceptional manner for formal non-practical examinations; yet in actual work these men fall far short of the graduates of schools in which the method of teaching takes little or no note of possible examinations, and they are usually not desirable from the hospital standpoint. Further, in comparing the percentage records of schools of known worth, due consideration must be given to the number of men examined and to the number of boards before which they have been known to appear. Schools with more than 100 candidates by the law of chance, are sure to suffer more than equally competent schools offering but 10 candidates for gradation by a board of examiners. Boards of examiners vary much among themselves; and the chance of a given number of candidates meeting stringent examiners and suffering commensurately in grades must increase with the number of boards at whose hands the class is examined. Further, inasmuch as the methods of home boards are more likely to be studied by candidates, as much or even more weight should be given to the records of each school before boards other than those of the home state.

Concrete examples may be offered in this wise. A number of medical schools in the tabulated records published in the *Journal of the American Medical Association* have perfectly clean records in the examinations of 1908, for the class graduating in 1908, for graduates between 1903 and 1908, and for graduates of all years appearing; yet in all of these the numbers of graduates examined have been small. The largest was the University of Indiana, with a total number of graduates (none of them antedated 1903) of 76, none of whom failed before any of the three boards before whom they appeared. Yet it is doubtful whether this record should be regarded as highly (and the writer believes to the contrary) as that of the Johns Hopkins University, with 73 candidates and a failure percentage of 2.7, when it is noted that the Hopkins men appeared before 22 state boards and that of 72 of the latter school (men from 1903 to 1908) but 18 appeared before the Maryland Board and the rest before the boards of 21 other states, while of the

Indiana men (none prior to 1903 being given) for the same years 74 appeared before the Indiana Board, and but two in other states.

Similar arguments might well be made in a comparison between Cornell and Harvard. Cornell it is true has a clean record, as has Indiana; but her 69 graduates appeared before but eight state boards in all years, and her graduates of 1908 before but two boards (51 of the total before the home board); while Harvard's 98 graduates appeared before 19 state boards, nearly half outside of Massachusetts, losing 8.2 per cent. by failure.

Undoubtedly of the largest and best known institutions of the country, the University of Pennsylvania presents in this report the most commendable record; and when one recalls how many of the smaller and less fortunately situated and equipped schools maintain by a method of "quiz" preparations their high ratings, and, further, under what particular disadvantages the large classes of such a school as Pennsylvania labor from the laws of chance and from the probability of encountering special difficulties in the distribution of candidates among large numbers of boards, it can scarcely be doubted that Pennsylvania might, with much reason, if so disposed, claim the position of honor for effective teaching and for general efficiency of her graduates. Of 196 graduates of all years, appearing before 27 state boards there was but 1 per cent. failure; of 176 graduates of 1903 to 1908 before 23 state boards there was but 0.6 per cent. failure; and of the 130 graduates of 1908 before 14 state boards none failed. In the 1903-'08 group, 104 appeared before the home state board with no failures; of the 72 appearing before the 22 other than home state boards, the single failure recorded took place.

It would perhaps be unwise to carry forward such comparisons, unless some such scheme as above outlined come to appeal to interested individuals in authority. But the tabulations cited are open for inspection and study at the hands of all; and their interpretation is not difficult if one keeps clearly in mind the special points to be included or evaded as the case may be.

Whatever the method, in the long run the hospital with careful and searching methods of examination will fare best, and the institution with hasty, slipshod and superficial examinations of candidates will suffer most as regards the relative efficiency

of the resident physicians, to whom is intrusted in so great a degree the care of the sick and wounded collected within its walls. It is probably true that the interests of a hospital would in the long run be best subserved by selecting a school known to be possessed of high facilities for undergraduate teaching in all lines, making a close affiliation with that school for a period of years, and relying upon the recommendations of the school officials for the choice of internes. The resulting benefit would be twofold—a marked stimulus to educational effort on the part of the school, since the loss of such hospital affiliation after it had once been established would reflect upon the teaching methods; and the impulse toward improving the average type of hospital resident throughout the country.

It is not unjust to either the medical schools—some of which are equal to any to be found in the world—or to hospital residents generally—many of whom are already everything that could be expected, and some of whom are as good as could be desired—to say that taken comprehensively, both schools and residents are susceptible of improvement, and many need it urgently and imperatively.

ROLAND G. CURTIN.

TECHNIC FOR A TEMPORARY ENTEROSTOMY.

EDITOR ANNALS OF SURGERY:

An enterostomy is always dreaded by the surgeon as well as by the patient because of the difficulty experienced in controlling the fecal discharge,—so that any change in technic that tends to improvement will not be unwelcome. One of the principal disadvantages of the artificial anus, especially in the small intestine, has been the difficulty experienced in regulating the escape of the contents of the bowel that keep the dressings of the unfortunate patient saturated almost constantly with liquid fæces. If the opening is allowed to remain for any length of time excoriations that are very painful often result. Attempts to control the fecal discharge have been confined principally to the descending and pelvic colon and these efforts have been partially successful. However, when the fecal current has been more or less successfully controlled there is frequently a marked prolapse of the mucosa. To avoid this difficulty the opening has been made

higher up in the colon; but the annoyance is obviated at the expense of fecal control.

I have recently performed an enterostomy of the ileum a few inches above the cæcum for a rectovesical fistula due to an intestinal amœbiasis, and I have had the happy experience during the two months that the artificial anus has been functioning, to see the skin of the patient's abdomen remain *absolutely* free from the slightest trace of moisture. This result, as far as I have been able to learn, has not been attained with the methods in general use.

In connection with this operation, a point of interest in the treatment of amœbiasis by making the enterostomy in the ileum, is worthy of mention. Dr. J. D. Long of the U. S. Marine Hospital Service, who has been associated with me in this case, suggested that the opening be placed in the ileum because of the great advantage that an enterostomy in this region possesses over the appendicostomy on account of the ease with which this part of the intestine can be irrigated; such irrigation is otherwise not possible.

In the technic about to be described, artificial anus of the small intestine is shorn of most of its horrors, at the same time a more complete cure of conditions calling for its employment, especially amœbiasis, may become possible.

Technic of the Operation.—A large loop of the intestine, preferably ileum, is drawn out and a spur is made according to any of the accepted methods; the skin is sutured in the ordinary way, and the loop is permitted to remain undisturbed until it is to be opened. Before the intestinal lumen is entered a small slit is made on one side of the centre of a large sheet of rubber dam such as is employed by dentists; this opening is stretched with the fingers, and while tense it is slipped over the loop of the intestine to its base. The rubber encircles the gut closely, just as it does when the dentist applies it over the tooth preliminary to a filling. The hole must be so large that the gut will not be strangled when the rubber contracts. The lower part of the rubber sheet that covers the side of the patient's body is directed into a bucket in which a small quantity of formalin has been placed; in the trough that is formed by the rubber sheet the fecal discharge passes into the container, so that the skin surrounding the artificial anus remains free from moisture.

As I have stated above, the skin of the patient referred to has never been moist, and he has not suffered the inconvenience and disgust that is usually associated with this kind of operation. Whenever soiling occurs from fæces, the rubber sheet and the exposed gut are easily cleansed by flushing with water poured from a pitcher. The important part of the technic is that the intestine is not to be cut flush with the skin, as is usually done, but it is allowed to remain indefinitely. The loop of the intestine exposed has remained normal in appearance and presents no evidence of sloughing.

CHARLES G. LEVISON,
San Francisco, Cal.

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Remittance for Subscriptions and Advertising and all business communications should be addressed to the

ANNALS OF SURGERY,
227-231 South Sixth Street,
Philadelphia.